Skin Diseases Of Large Animals*

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VETERINARY dermatology as a special branch of veterinary medicine has been neglected. Best proof of it is in articles concerning various skin disorders. They illustrate essential confusion.

Examination of the skin, hair coat, and subcutaneous tissues is important not only in diagnosing skin disease but also as a source of valuable information leading to more specific diagnosis of numerous internal disorders. In a very real sense skin may be said to be the mirror of general health of the organism. Integument reflects changes closely associated with pathology in other organs, various systemic disorders, and the consequences of deficient nutrition.

Skin disorders may therefore result from different etiological factors. Some of these may act directly upon the skin itself, or indirectly via the blood, lymph, or nervous systems. These factors may act independently or in combinations. Some species of animals are especially susceptible to dermatoses.

Classification of skin disorders may be approached from several standpoints. It may be based upon pathological-anatomical changes, functional disorders, or upon the origin of cutaneous disease.

Dermatitis

Skin inflammations involve mainly the deeper cutaneous layers, in contradistinction to eczemas which are of a superficial character. In acute dermatitis, hyperemia and exudation predominate, while in chronic dermatitis excessive infiltration is the main pathological symptom. Appearance varies with potency of the causative agent. The lowest degree of acute dermatitis is called erythematous dermatitis; higher degrees are vesicular, bullous, and pustular microgenic dermatitis. The highest degree is characterized by superficial or deeper necrosis and is designated escharotic dermatitis. Chronic dermatitis is caused by the same agents producing acute dermatitis. Microgenic chronic dermatitis is often of bacterial or fungal origin such as actinobacillosis, botryomycosis, and tuberculosis.

The author of this article and of Skin Diseases of Small Animals, which appears elsewhere in this issue, is an eminent veterinary dermatologist. Doctor Kral's Veterinary Dermatology, now being published by the J. B. Lippincott Company, Philadelphia, Pa., will be available in May or June. This textbook promises to be a comprehensive treatise of dermatoses of both large and small animals. The price has not been announced.

Eczema

Eczematous skin lesions occur mostly in small animals; however, even large animals, especially horses and cattle, may be affected. The basic explanation of eczema will be discussed in the sections concerned with small animals. This particular section will describe only the various types of eczema in large animals.

In horses, the chronic squamous crustaceous eczema is most common. Lesions are always symmetrically distributed and are localized, as a rule, on both sides of the neck, shoulders, and on the chest. These changes are of a long duration and cause pronounced thickening of

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the skin. During the winter, there is marked improvement, sometimes complete recovery. With return of summer, the disease recurs. It is, therefore, often called "summer mange."

Scratches, or eczematous greasy heel, is another type of equine eczema, appearing in the fetlock region. Occasionally it may be the

Fig. 1. Summer mange.

result of virus infection, so-called "horse pox." Saddle eczema develops in the saddle region. It is localized in the posterior saddle area and may be acute, moist, or of a chronic crustaceous character.

Seborrhoic eczema is another type of horse eczema. It is associated with excessive production of sebum.

In cattle, various types of eczematous skin changes have been found. They especially develop among individuals which are malnourished, neglected, or kept in dirty, damp stables. Eczema occurs mainly on the limbs, neck, root of the tail and sometimes on the forehead. The lesions may be scaly, weeping, or pustular. In more chronic conditions, there are thick crusts which leave weeping skin areas when removed.

In sheep, a particular type of chronic squamous eczema appears as a sequel to intoxication caused by chronic wasting diseases such as distomatosis and strongylosis. Moist eczema of sheep, "fat scab" or acute weeping eczema, develops mainly on the neck, head, shoulder, and croup region during cold and damp weather.

In pigs, eczematous skin lesions may also develop. They are found especially among young pigs suffering from malnutrition and poor care, or in mature pigs after excessive feeding of fish meal.

The treatment of eczemas of large animals, as in small animals, should be provided both internally and externally. Frequently a change of diet may improve essentially the condition. In cattle, especially, high protein diet has been successful. Good results have been achieved with autogenous hemotherapy which stimulates not only the reticuloendothelial system but the adrenal cortex as well. Summer mange of horses responds to four to five intramuscular injections of 80 to 120 cc. of autogenous blood.

Urticaria

Urticaria as a specific skin disorder occurs mainly in horses, cattle, and pigs, forming wheal-like cutaneous eruptions. These lesions appear and disappear rapidly. They may be of infectious or toxic origin.

Serum Sickness

Serum sickness has mostly been observed in cattle after serum, especially horse serum inoculation, and after blood transfusion. To reduce the danger of serum sickness from injections of foreign proteins, it is advisable to apply the initial dose in small amount and administer the full dosage several hours later.

Drug Eruptions

Skin eruptions caused by drugs develop in large animals after internal or external application of various agents. Arsenic preparations applied for a long period of time may produce a typical hyperkeratosis of the skin and mercury poisoning has been noted frequently in connection with mercuric sublimate used externally, or calomel employed internally. Acute

Fig. 2. Hyperkeratosis and papillomatosis.

symptoms are characterized by vesicles and pustules, chronic exanthema appearing in the form of squamous-crustaceous dermatosis. Itching is intense.

Iodine and its derivatives may produce skin eruptions, particularly in cattle after extended internal treatment against actinomycosis. Lesions are characterized by extensive epidermal desquamation and alopecia.

Sulfonamides used for treatment of infectious disease also have caused cutaneous manifestations. Excessive use of vitamins, especially ascorbic acid, may also produce various disturbances, including cutaneous symptoms.

Food Eruptions

Foods frequently causing skin eruptions in large animals include potatoes and their waste products, distillery wastes, malt, coconut cake, buckwheat, clover, lucerne, St. John's wort, and others.

Fig. 3. Warts.

Hypertrophic Changes

Hypertrophic changes of the cutaneous cellular tissue are most frequently found on the hind legs of horses and result in elephantiasis. In cattle, similar skin lesions have been observed in the brisket region and on the head.

Scleroderma, or dermatosclerosis, is characterized by board-like hardening of the affected skin.

Psoriasis, which occurs more often in dogs, has also been described in horses.

Hyperkeratosis of domestic animals may be either congenital or acquired. Ichthyosis, or fish-skin disease, is a form of congenital hyperkeratosis and has been found mainly in calves. The best example of acquired hyperkeratosis is hyperkeratosis of cattle, originally termed X-disease. The disease is systemic with evident cutaneous symptoms. It occurs not only in cattle, but in sheep and pigs as well. The cause is intoxication, deficiency, or combination of both.

Tumors

Skin tumors occur in large animals with relative frequency. They can develop from epidermis, dermis, and subcutaneous tissues. They may be benign or malignant.

Cutaneous horn has been found particularly in cattle and horses, regardless of breed, sex, or age. They are benign tumors.

Warts, or cutaneous papilloma, are found in cattle and horses. They may be congenital or acquired in origin. Considerable uncertainty exists regarding the real cause of warts. Many experiments have indicated that they can be transmitted, particularly in young animals, with apparent lowered resistance. Attempts to induce growth of warts artificially or naturally have met with failure. Vaccine therapy has likewise been unsuccessful in many cases. There is evidence that warts may develop from chronic irritation of the skin and from hereditary predisposition. They also develop in the course of hyperkeratosis in cattle.

Epidermoid carcinoma, malignant tumors of the epidermis, occurs relatively often on eyelids, lips, prepuce, penis, and vulva of horses and cattle. Surgical excision has been used in the treatment of early cases. *X*-ray therapy is the most effective treatment in most types of epidermoid carcinomas.

Fibrosarcomas and neurogenic sarcomas are malignant tumors of the dermis. Treatment of this group is limited to radical surgery.

Malignant melanoma frequently occurs in horses, particularly grays. Excision may be successful only with small, solitary, malignant melanomas favorably located with no metastatic complications.

Fig. 4. Generalized seborrhea.

Functional Diseases

Functional diseases of the skin include disorders of sensation, disturbed functioning of sweat and sebaceous glands, and deviations in hair and pigment development.

Pruritus may be a generalized itching which frequently occurs as secondary cutaneous

manifestation of chronic kidney, liver, and digestive diseases. It may accompany hormonal disorders, nervous diseases, parasitic intoxications, allergies, and dietary extremes, such as long feeding on corn and wetch by horses.

Fig. 5. Congenital alopecia.

Local pruritus often is seen as a secondary symptom of certain systemic diseases. It has been observed in cattle during pregnancy toxemia.

Injections of procaine, administered in a 0.1% solution, 4 cc. per lb. of body weight by the drip method over a period of an hour, have been recommended for the treatment of pruritus. Hormone therapy may also be used.

Disorders in activity of the sebaceous glands occur in large animals as increased production of sebum, resulting in formation of fatty crusts. The real cause is unknown, however. It has been observed in horses as a sequel to influenza and contagious pneumonia. There is no effective treatment of generalized seborrhea.

Functional disorders in sweat gland secretion develop in large animals as hyperhidrosis, anhidrosis, hematidrosis, or uridrosis.

In British West Indies, a special type of anhidrosis developed in Thoroughbreds. The onset was gradual, the development lasting a year, and the animal failing physically. Sudden death ensued when these horses were continued in racing. The cause was found to be related with loss of blood chlorides. The blood chlorides level dropped from a normal of 480 to 248 mg. per 100 cc. Intravenous injections of sodium chloride in 500 cc. doses of normal saline solution containing 10% glucose were effective and the horses began perspiring again.

Hair disorders of large domestic animals occur mostly as loss of hair or wool either as congenital or acquired alopecia. Congenital alopecia has been noted particularly in calves and foals and it has been considered to be a mendelian recessive trait. Acquired alopecia usually is associated with nutritive disturbances, internal disorders, infectious diseases, and not rarely with disorders of endocrine secretion and those caused by *x*-ray irradiation.

In horses, some structural disorders of the long hair, particularly of the mane and tail, have been observed as trichoptilosis and trichorrhexis nodosa. The etiology of these hair disorders is not known; the course is very protracted; the treatment relatively difficult.

Infectious Diseases

Skin manifestations occurring in large animals in the course of infectious diseases are caused by viruses, bacteria, fungi, protozoa, and metazoa.

Skin manifestations of virus origin develop in the course of pox infection. Cow-pox is seldom observed and the natural infection takes place mainly by contact with human beings, especially children who have been vaccinated against small pox. The transmission of the disease from cow to man is easy, particularly by the hands. The hand manifestations are called "milker's nodules"; they may also occur on the face.

Fig. 6. Gangrene of snout and ears, caused by Erysipelas.

Infectious vesiculo-pustular exanthema, or infectious scratches of horses, occurs on the posterior fetlock region. Pustular stomatitis has the same etiology. They are both produced by the horse-pox virus.

Orf, or contagious vesiculopustular dermatitis or contagious ecthyma, develops as a result of a virus infection of sheep and goats.

Coital vesicular exanthema, rinderpest, and malignant head catarrh of cattle, foot-and-mouth disease, and vesicular exanthema of swine are other virus infections in the course of which serious skin lesions may develop.

Strangles in horses has recently been found to be a virus disease and *Streptococcus equi*

Fig. 7. Psoroptic mange in a sheep.

has been shown as a secondary invader. Cutaneous form of strangles is characterized by urticarial and vesicular eruptions which soon turn into abscesses in superficial lymphatics and superficial lymph glands.

Hog cholera, pemphigus, and scrapie in sheep are other virus infections with skin manifestations.

The most important skin manifestations occurring in course of infectious diseases caused by bacteria are impetigo, acne, and furunculosis, contagious pustular dermatitis in horses, erysipelas, swine erysipelas, anthrax, malignant edema, tuberculosis, glanders, and ulcerous lymphangitis in horses.

Infectious dermatosis can be caused by fungi. In recent years an increasing number of fungus infections have been recognized in animals and in man. Blastomycoses and dermatomycoses, such as ringworm and favus; mycetomycoses, such as actinomycosis; actinobacillosis; streptothrichosis; botryomycosis; and sporothrichosis are represented.

The most important fungi are dermatophytes. In identifying these cultures, microscope, or ultra-violet-lamp methods may be used. The fluorescence test with Wood's lamp is effective in about 50% of the cases.

Infectious diseases caused by protozoa and showing some skin manifestations are babesiosis of horses, surra, dourine, and leishmaniasis.

Dermatosis associated with helminths occur mostly in cattle and horses, and are caused mainly by nematodes.

Stephanofilariasis causing nematode dermatitis has been reported in dairy cattle. Parafilariasis or "summer bleeding" of the skin has been found in horses and cattle where the parasites form bloody nodules.

Cutaneous habronemiasis, bursati, appears on horses during the summer season in warm climates.

Many dermatoses occurring in large animals are associated with ticks and mites. They may produce not only mechanical disturbance of the cutaneous tissues but toxic effects as well, or they may transmit infectious diseases.

Mange mites are the most serious and feared external skin parasites of domestic and wild animals and human beings. During and after World Wars I and II sarcoptic mange of horses and cattle spread over the whole of Europe. In 1945 and 1946, the author and colleagues treated over 30,000 horses suffering from sarcoptic mange; gas fumigation (sulfur dioxide) has been the most reliable treatment, not only in horses but in cattle and sheep.

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Incidence of Trichinae Infection

Results of a survey by the Meat Inspection Division over a period of three years are included in the annual report for 1952 of the Chief of the Bureau of Animal Industry.

Over 3,000 diaphragms from pigs originating in the Midwest were collected at random at meat-packing establishments operating under federal inspection. Examination was by direct microscopic methods and the digestion technic. Only 19 of 3,031 samples (0.16%) were found to contain trichinae and in these instances only in small numbers — five trichinae per 1,000 gm. (2 lb) to two per gram in all except one sample which contained between seven and eight per gram of muscle.

In a study conducted by the same technic of 1,328 samples from garbage-fed hogs, 149 (11.2%) were noted to be infected. Furthermore, actual counts of parasites revealed 100 to over 2,700 per gm. of tissue.

Present-day frequency of trichinae in farm-raised swine is markedly reduced in recent years, but remains constant for those fed raw garbage.

Antibiotics: Synergism And Antagonism*

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MUCH progress has been made during the past ten years in the development and use of antibiotic substances. These relatively new chemotherapeutic agents are used widely in the treatment of animal and human infections and each has certain characteristics that should be taken into consideration when they are used clinically. Some are used topically while others may be administered orally or parenterally. Certain of them are active against Gram-positive organisms, while others are active against Gram-negative ones. Some are active against both types of bacteria and are active against other organisms, such as Rickettsia and Protozoa. The frequency with which these substances must be administered and the most desirable route also vary. Certain combinations appear to have desirable effects against some infections while other combinations actually may be less effective than when the drugs are used singly. In many instances, certain agents that are not suitable for parenteral therapy are used for local application to preclude development of sensitivity by the patient, or drug-fastness by attacking organisms, to an agent that may subsequently be useful for systemic therapy.

A brief resumé of antibiotic substances of clinical interest follows.

Antibiotics of Clinical Importance

Tyrothricin
Penicillin
Streptomycin and Dihydrostreptomycin
Aureomycin
Bacitracin
Chloramphenicol (Chloromycetin)
Terramycin
Polymyxin B
Neomycin
Erythromycin

Tyrothricin

Source	*Bacillus brevis*
Stability	Stable in most preparations
Solubility	Soluble in alcohol, propylene glycol, etc. Relatively insoluble in water
Toxicity	$L.D._{50}$ I. V. 2.0 mg./kg. (mice)
Administration	Topical and by infusion

Tyrothricin in solutions or ointments is applied topically in the treatment of infections caused by Gram-positive bacteria. This agent is quite stable under most circumstances. It is too toxic for parenteral use and is not considered to be effective when given orally, although large amounts, given orally, will cause a reduction in the number of organisms in the bowel.

Penicillin

Source	*Penicillium notatum* or *P. chrysogenum*
Stability	Stable when dry and in anhydrous media Unstable on storage in aqueous menstrua
Solubility	Very soluble in water
Toxicity	Na G. I. V. $L.D._{99}$=3,335,770 u./kg. $L.D._{50}$=5,030,500 u./kg.
Administration	Oral, topical and parenteral

Penicillin undoubtedly is the most exciting chemotherapeutic agent known today.

Several types are recognized, F, G, K, X, and O; however, type G generally is used clinically. Various salts of penicillin have been prepared; of these sodium, potassium, calcium, procaine, and aluminum salts have been of clinical interest. Within the past year, two other slowly disintegrating salts, benzethacil (bicillin®[1]) and 1-ephenamine penicillin G (compenamine®[2]), have been reported.

The pharmacologic characteristics of these salts are of interest clinically since rates of absorption and elimination are influenced. Rapid absorption following intramuscular or intravenous administration of sodium or potassium salt will produce high blood and tissue levels promptly. However, these levels cannot be maintained unless the rate of renal excretion is depressed by use of agents such as para-aminohippuric acid, iodopyracet (diodrast®[3]), carinamide (staticin®[4]) or probenecid (benemid®[4]). Salts, such as procaine penicillin,

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®[1]Wyeth, Philadelphia, Pa.
®[2]Commercial Solvents Co., Terre Haute, Ind.
®[3]Winthrop-Stearns, Inc., New York, N. Y.
®[4]Sharp & Dohme, Inc., Philadelphia, Pa.

benzethacil, or 1-ephenamine penicillin G permit slow release of penicillin following intramuscular administration, so that high levels in body fluids are not obtained; however, resulting low levels are maintained for relatively long periods. Penethamate, the hydriodide of diethylaminoethyl ester of penicillin G (leocillin®[5], neo penil®[6]) has been shown to possess unique characteristics in that higher concentrations have been found in pulmonary tissue after a given dosage than would be predicted from experience with other salts.

Penicillin is used widely especially in treatment of infections caused by Gram-positive organisms. This substance may be administered by almost any route. It is relatively free of the danger of producing toxic reactions.

Streptomycin and Dihydrostreptomycin

Source	*Streptomyces griseus*
Stability	Stable when dry and in aqueous solution
Solubility	Very soluble in water
Toxicity	Streptomycin—$L.D._{50}$ 4500 mg./kg. Vestibular disturbances and 8th nerve damage may occur when large dosages are administered to human beings and experimental animals
Administration	Parenteral or oral

Streptomycin and dihydrostreptomycin are supplied as sulfate salts; streptomycin is used also in the form of calcium chloride complex. These antibiotics are active against many Gram-negative, and a few Gram-positive organisms. It is of interest to note that several Gram-positive bacteria that are not sensitive to penicillin are affected by these agents. In treatment of systemic infections, the substances are administered intramuscularly; for enteric infections they are given orally. Neither is absorbed to any appreciable degree from the gastrointestinal tract.

Streptomycin and dihydrostreptomycin are eliminated fairly rapidly from the body and it is necessary to administer the substance frequently to maintain effective blood levels. Repository dosage forms are not available. Excessive amounts of these agents are capable of producing neurotoxicity, chiefly localized in auditory and vestibular nerves. This complication is exceedingly rare in animals. Streptomycin is used locally especially in treatment of bovine mastitis caused by Gram-negative bacteria.

®[5]Leo Pharmaceutical Products, Copenhagen, Denmark.

®[6]Smith, Kline & French, Philadelphia, Pa.

Bacitracin

Source	*Bacillus subtilis*
Stability	Unstable on storage in aqueous menstrua
Solubility	Very soluble in water
Toxicity	$L.D._{50}$ 360 mg./kg. (7500 units)
Administration	Oral, topical and by infiltration

Bacitracin is particularly active against Gram-positive organisms and in this respect is similar to penicillin. Usually it is administered orally for treatment of certain enteric infections and topically for localized infections. Solutions of bacitracin have been injected into and around infected lesions and in some instances been used for systemic infections.

Neomycin

Source	*Streptomyces fradiae*
Stability	Dry powder stable indefinitely
Solubility	Soluble in water
Toxicity	$L.D._{50}$ P. O. 6450 mg./kg. (mice)
Administration	Oral and topical

This relatively new antibiotic substance possesses antibacterial activity against both Gram-positive and Gram-negative organisms. It is administered orally in enteric infections, and topically for localized infections. Currently, it is not recommended for parenteral therapy because of danger of toxicity.

Polymyxin B

Source	*Bacillus polymyxa*
Stability	Relatively stable
Solubility	Soluble in water
Toxicity	$L.D._{50}$ I. P. 12.1 mg./kg. (mice)
Administration	Topical and oral

Polymyxin B is another relatively new antibiotic substance with some interesting properties. There are various polymyxins, identified by the letters, A, B, C, D, and E. Pharmacologic and clinical investigations have shown clinical superiority and lower toxicity of polymyxin B; when administered orally it is sparingly absorbed. Polymyxin B appears to have selective activity in *in vitro* tests against a wide variety of Gram-negative organisms; among these is *Pseudomonas aeruginosa*. This is of particular interest to the clinician since most other chemotherapeutic agents are not active against this organism. The substance is used chiefly for local therapy and parenteral administration is suggested only in selected and well managed cases.

Aureomycin-Terramycin-Chloramphenicol

AUREOMYCIN

Source	*Streptomyces aureofaciens*
Stability	Stable in dry form Unstable in solution
Solubility	4 mg./cc. in water
Toxicity	$L.D._{50}$ I. V. 134 mg./kg. (mice) $L.D._{50}$ P. O. 1500 mg./kg. (mice)
Administration	I. V. topical, and oral (except adult ruminants)

TERRAMYCIN

Source	*Streptomyces rimosus*
Stability	Stable in dry form
Solubility	Soluble in water
Toxicity	$L.D._{50}$ I. V. 176 mg./kg. (mice)
Administration	I. V. topical, and oral (except adult ruminants)

CHLORAMPHENICOL

Source	*Streptomyces venezuelae*
Stability	Stable when dry, relatively stable in aqueous solution
Solubility	2.5 mg./cc. in water
Toxicity	$L.D._{50}$ I. V. 245 mg./kg. $L.D._{0}$ oral 1 gm./kg. depression with recovery
Administration	Oral and I. V.

These three interesting chemotherapeutic agents frequently are referred to as the "broad spectrum" antibiotic substances. They are active against Gram-positive, Gram-negative, rickettsial, large viral, and some protozoan organisms. Chloramphenicol (chloromycetin®[7]) is prepared both synthetically and by fermentation. The substances usually are administered orally, except in adult ruminants, intravenously, or topically. In preparing solutions for intravenous administration it is important to use proper diluent and to administer the solution soon after preparation. The oral administration of these substances to adult ruminants may cause digestive disorders. It is assumed that this is caused by resulting suppression of the beneficial population of organisms in the rumen.

The wide spectrum that these agents possess has made them valuable in the treatment of various clinical entities in veterinary practice; however, their performance against infections caused by viruses has been disappointing. Many viral infections in animals are caused by small viruses that apparently do not respond to therapy. This indeed is unfortunate; however, the substances often are effective in controlling the common secondarily invading organisms and for this reason frequently are useful in management of viral diseases.

®[7]Parke, Davis & Company, Detroit, Mich.

Since the chemotherapeutic armamentarium of the clinician has grown considerably during recent years the question frequently arises as to whether more than one agent should be administered to the patient at the same time. The choice of agent or combination of agents must be made. To many, it has seemed reasonable to assume that if one agent is useful, two or more employed simultaneously should be better. This has led to great increase in indiscriminate use of mixtures of antibacterial agents. The apparently increasing frequency of development of resistance to certain antibiotic substances, as well as a number of reported failures to obtain satisfactory responses in patients with the use of a single agent or a combination of chemotherapeutic agents, indicate a need for further study of therapeutic procedures.

Synergism and Antagonism

Dorland's[1] definition for synergism is, "the correlated action or cooperation on the part of two or more structures or drugs"; for antagonism, "opposition or contrariety as between muscles, medicine, or organisms"; and for antagonist, "a remedy which tends to nullify the action of another remedy."

The phenomena of synergism and antagonism of antibiotic substances has been studied extensively by Dr. Ernest Jawetz and his associates at the University of California. In one of their many publications[2] they state: "Early in this work, it became apparent that pairs of antibiotics did not exhibit constant and fixed behavior. Uniformly synergistic or antagonistic pairs did not exist. Antibiotic A might be synergistic with B against one microorganism, antagonistic to B against another, and independent of B against a third. The behavior of the microorganism in question and not a chemical or physical interaction of the drugs determined the result of combined antibiotic action. Generalizations were, therefore, impossible not only for the behavior of drug pairs but even for their behavior against a given bacterial species, because individual strains differed greatly in their susceptibility to different antibiotics. The hypothesis, therefore, has to take into account the behavior of individual strains of organisms."

They have proposed that some of the useful antibiotic substances may be classified into two groups: I—containing penicillin, streptomycin, bacitracin, and neomycin; II—containing aureomycin, chloramphenicol, and terramycin.

These workers have indicated that, "mem-

bers of group I are frequently synergistic with each other, occasionally indifferent, but have never in our hands been antagonistic to each other . . . Members of group II are neither synergistic with, nor antagonistic to, each other, but simple additive effects are observed, presumably also obtainable by an increase in the dose of a single drug." They further state that, "combined effects between drugs of group I and group II are the most complex and depend on the relative susceptibility of the microbial strain. If the microorganism is susceptible to the group I drug, then group II agents will frequently be antagonistic and reduce the effect of the group I drug. This effect seems to be unilateral: Group I drugs do not interfere with group II action against organisms tested thus far. If, on the other hand, the bacterium is group I resistant (but can be inhibited by a large dose) then I plus II sometimes result in synergism, never in antagonism."

Unfortunately, the sensitivities of many animal pathogens to antibiotic substances have not been determined and little is known regarding the effect that combinations of such agents may have on them in the animal body. Thus, it seems reasonable to expect synergy and not antagonism when agents of group I are combined. The use of combinations, or the simultaneous administration of several members of group II appears to be illogical unless warranted for pharmacologic reasons. It would be undesirable to add drugs of group II to an agent of group I if the infecting organism is sensitive to the group I substance.

Verwey *et al.*[3] have found that a combination of tyrothricin and bacitracin possesses true synergy in *in vitro* tests conducted with streptococci, staphylococci, and diplococci. This was also demonstrated in a so-called bioassay test in which human saliva was injected into mice. The saliva of some humans is lethal to mice when it is given parenterally. Human subjects possessing this toxic saliva used tyrothricin, bacitracin, and combinations of half quantities of these substances in lozenges at various intervals. Again saliva was collected and injected into mice, and the mortality determined. It was found that the tyrothricin alone caused a 5.83-fold decrease, and bacitracin alone a 2.16-fold decrease, in mortality. However when the two agents, each in half quantity, were combined, there was actually a 19.0-fold decrease in the mortality of mice.

An apparent synergistic action of several antibiotic substances in human patients has been reported by Robbins and Tompsett,[4] who indicated that penicillin and streptomycin produced good results in the treatment of several cases of subacute bacterial endocarditis. This was observed also by Cates and his associates[5] and by Hunter[6].

In vivo antagonistic action between two antibiotics was noted by Lepper and Dowling[7] who used penicillin alone, and a combination of penicillin and aureomycin in the treatment of pneumococcic meningitis. They state that, "it appears unwise to use combinations of penicillin with aureomycin, terramycin, or chloramphenicol in treatment of patients with pneumococcic meninigtis or in treatment of any patients, even those with milder infections in which antagonism has been shown *in vitro*." Similar observations in which aureomycin and terramycin were found to interfere with the action of penicillin in experimental infections with a Streptococcus or Klebsiella organism in mice, were reported by Speck *et al.*[8]

Summary

There is no question concerning the beneficial value of antibiotic agents, properly selected and used in the treatment of infections in animals. There is evidence that antibiotic combinations will produce a favorable response in certain infections, however, the arbitrary use of mixtures or of simultaneous administration of several such substances can not be recommended because antagonism may occur.

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Diagnosis Of The Carrier Stage Of Anaplasmosis Under Experimental Conditions†

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ANAPLASMOSIS is considered one of the most serious and costly diseases affecting beef and dairy cattle in many sections of the South. Due to its economic importance in Florida, research work on various phases of the disease has been in progress for a number of years at the Florida Agricultural Experiment Station. Anaplasmosis is produced experimentally under controlled conditions in calves and yearling steers. Infective material used in these investigations was collected from clinical cases of the disease in several field outbreaks which have occurred throughout the state.

Results of experiments are presented in this report in which diagnosis of the anaplasmosis carrier stage was made by:

(1) The injection of carrier blood into disease-free animals; (2) the study of relapses following removal of the spleen of carrier animals; and (3) the injection of carrier blood into splenectomized, disease-free calves.

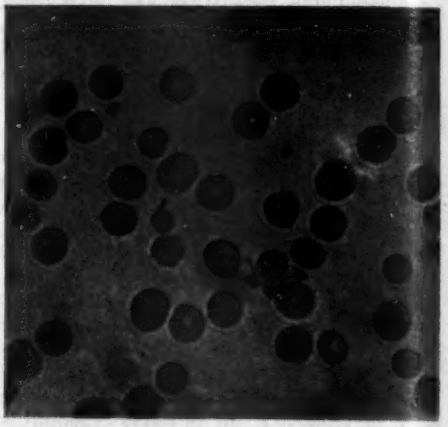
De Kock and Quinlan,[1] Quinlan, De Kock, and Marais,[2] and Rees[4] have reported upon diagnosis of the carrier stage of anaplasmosis by the use of splenectomy operation. Work conducted at the Kansas Experiment Station[5] has revealed that splenectomized, anaplasmosis-free animals are highly susceptible to the disease.

Diagnosis of the Carrier Stage of Infection

Detection of the carrier stage of bovine anaplasmosis may be accomplished by injecting disease-free animals with blood from a suspected carrier under controlled conditions. The incubation period of this blood disease, as determined at this station, varied as shown in table 1 when carrier blood was used as the source of inoculum.

Splenectomy in anaplasmosis-recovered, carrier animals resulted in relapses. Such relapses were accompanied by typical symptoms and recurrence of Anaplasma in the peripheral circulation as determined by microscopic examination of stained blood smears.

Splenectomy in calves is a relatively simple operation and has been accurately described by De Kock and Quinlan,[1] and Quinlan, De Kock and Marais[2]. In performing the operation on approximately 15 animals, a few changes have been made in the Onderstepoort workers' technic. General anesthesia is not employed. Epidural anesthesia (2.5% procaine hydrochloride containing ephedrine hydrochloride) is administered to the point at which the calf goes down and posterior limbs become completely relaxed. As much as 50 ml. of procaine solution have been administered epidurally to a 350 lb. animal to secure the desired effect. Additional amounts of anesthetic are often injected during the operation. No ill effects have resulted from the use of large amounts of epidural anesthesia and all animals regained standing position at least by the morning following the operation. This, combined with paravertebral anesthesia[3] and infiltration of skin and muscle over the line of incision with procaine solution, gives complete anesthesia. Following removal of the spleen,



Photomicrograph of blood smear illustrating typical anaplasmosis (*Anaplasma marginale*).

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an aqueous solution of penicillin is instilled into the abdominal cavity. The peritoneum and muscle layers are sutured with catgut and the skin incision closed with 16 M/M Michel-type metal wound clips. No fatalities have ensued as a result of operative technic.

In these experiments, relapses in carriers of anaplasmosis have been severe as a result of the splenectomy operation. De Kock and Quinlan[1] and Rees[4] reported that carriers of bovine anaplasmosis pass through mild relapses after surgery.

TABLE 1. Incubation Period of Anaplasmosis

Citrated Carrier Blood Injected ml.	Route of Injection	No. of Days Incubation Period
750	Intravenous	20
20	Subcutaneous	20
10	Intravenous	16
10	Intravenous	21
30	Intravenous	16
200	Intravenous	7
250	Intravenous	10
10	Subcutaneous	15

During the past two years, spleens of eight anaplasmosis carriers have been removed. Seven of these animals died as a result of a relapse. Immediately prior to death, hemoglobin content of the blood of the affected calves was so depleted that it was unreadable on a photoelectric cell hemoglobinometer. Blood smears revealed that almost 100% of the erythrocytes were parasitized with two or more Anaplasma bodies. Hematuria occurred in one case. Smears prepared from urine sediment of this animal revealed the presence of red cells containing Anaplasma. In rare instances hematuria has also been observed in peracute field cases.

Following splenectomy, all carriers relapsed to anaplasmosis. The postoperative incubation periods are given in table 2.

The course of infection in animal no. 134 following splenectomy relapse differed somewhat from that observed in calves no. 42, 41, 60, 135, 40, and 173. The latter mentioned animals succumbed within 12 to 19 days following removal of the spleen. Approximately all erythrocytes were parasitized. No. 134 also exhibited symptoms of the disease for the second time following splenectomy. The calf apparently recovered from the relapse phase as far as could be determined by symptoms and blood examinations. However, 202 days after the operation this animal exhibited clinical symptoms for the third time and died on the 204th postoperative day.

Workers at the Kansas Experiment Station have noted that splenectomized, anaplasmosis-free calves react with a severe manifestation when injected with carrier blood or blood collected from acute cases of anaplasmosis[6]. Results of these experiments concur with those of the Kansas investigators. Table 3 tabulates the data with regard to six calves handled as outlined above.

TABLE 2. Postoperative Incubation Period in Anaplasmosis Carriers

Animal Number	Incubation Period Days	Postoperative Death Days
42	5	14
41	3	12
60	12	16
135	10	16
40	8	19
173	5	13
134	6	204
132	11	living at 67th day after operation

Animal no. 61 developed a severe clinical case of anaplasmosis following an incubation period of 14 days, but from all apparent symptoms, hematological and microscopic examinations, complete recovery was effected. However, about one year later the calf relapsed and died.

Staining of Blood Films

Giemsa blood stain (original azure-blend type) was used in the examination of blood smears. Blood films are air dried and fixed

TABLE 3. Incubation Period of Anaplasmosis in Splenectomized, Disease-free Calves

Animal Number	Date of Splenectomy	Date and Quantity Carrier Blood Injected	Number of Days Period of Incubation	Treatment	Date of Death
71	9/12/50	11/1/50, 30 ml., intrav.	14	APF	11/23/50
72	9/13/50	11/1/50, 30 ml., intrav.	14	Aureomycin	12/28/50
73	9/26/50	11/1/50, 30 ml., intrav.	13	None	11/20/50
61	6/22/50	8/31/50, 30 ml., intrav.	14	None	9/25/51
130	6/28/51	1/3/52, 130 ml., intrav.	15	None	1/26/52
138	5/25/51	1/3/52, 130 ml., intrav.	13	None	1/25/52

in special, pure, neutral, acetone-free methyl alcohol. They are stained with Giemsa's stain which has been diluted in neutral, distilled water, nine drops of stain per 10 cc. of water. Staining is allowed to progress for ten minutes before the smears are washed with neutral distilled water.

Summary

1. Three procedures are available for diagnosis of the carrier stage of anaplasmosis infection under experimental conditions. Blood from the suspected carrier may be injected into an anaplasmosis-free animal. Splenectomized, disease-free calves are suitable for use in detecting the carrier stage. Splenectomy can also be utilized to detect carrier animals.

2. Postoperative relapses to anaplasmosis following the splenectomy were severe.

3. Splenectomized anaplasmosis-free calves react with a severe manifestation of the disease when injected with virulent blood.

4. Giemsa blood stain is preferred for detection of Anaplasma.

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Two articles in the *American Journal of Veterinary Research* (14:5 [Jan.], 1953) by Nicholas H. Booth and A. Donald Rankin, describe experiments in determining the application of curare to equine practice. They found the maximum safe dose to be ⅝ unit per lb. of body weight, but this dosage paralyzed only half of the animals. Doses up to and including the established toxic dose did not totally abolish the spinal reflex.

The authors also used curare as an adjunct to chloral hydrate in anesthesia. Spinal reflex activity was not abolished. The authors conclude that curare does not have potential value as an adjunct to chloral.

Changes in Vesicular Exanthema Program Under Study

Livestock health officials of the USDA met February 16 and 17 in Chicago with representatives of farm organizations, livestock industry groups, and state livestock sanitary boards and commissions, to discuss possible changes in plans to eradicate the contagious swine disease vesicular exanthema.

There was general agreement by all groups represented that present cooperative efforts by the states and the USDA to eradicate the disease be continued, and that serious study be given to improve the existing program.

Since June 16 the disease has appeared in 34 states, other than California where it first appeared 20 years ago. There has been a pattern of reinfection, particularly in areas where large numbers of swine are fed on raw garbage.

The garbage problem was the center of the Chicago discussions; many suggestions from the interested groups are now under study.

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Overfeeding versus Underfeeding

Just as overtreatment has gained favor in some quarters, so has overfeeding gained approval in others. It is a wasteful procedure in that not only is food wasted, but overfed animals often develop digestive disturbances with resultant loss of production and weight. It has been found to be sound procedure to feed animals just a little less than they can eat.

In this era of extremes we find others prone to underfeeding. This is as harmful as feeding too much. It is uneconomical. An animal must not only produce, but must maintain itself and grow. Unbalanced rations are a form of underfeeding, even though the ration is plentiful.

The extremes must be melded into a middle way. Each farm animal should be fed according to individual needs. The most economical and safe way to do this is to weigh or measure feeds.

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There are three possible dangers inherent to including antibiotics in the feed of livestock:

1. It may be improvident to interfere with the natural growth rate, and once altered it may be necessary to maintain the new level.

2. In ruminants, antibiotics may possibly cause changes in rumen flora.

3. There is danger of building antibiotic-resistant strains of bacteria.

Skin Diseases Of Small Animals*

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THE most disputed skin disorder in dogs is eczema. It is difficult to formulate a clear definition of the disease and often it is said to be dermatosis of unknown origin. Hutyra, Marek and Manninger use the term eczema to describe a distinct form of superficial inflammation of the skin, somewhat resembling catarrh of the mucous membranes. Bonjour and Rashewsky propose the theory that eczema is intimately related to vasomotor tension exerted upon both the skin and glandular system. Sharp and Slanetz present a number of factors which may contribute to development of eczema, particularly deficiency producing imbalance in metabolism. Samberger, a human dermatologist, calls attention to disturbances in the lymphatic secretion and circulation as essential factors, while Highman considers eczema an exudative cutaneous inflammation, which never occurs as external disease alone. It is always associated with internal disorder. Therefore, to distinguish eczematous skin disorder it is necessary to be a good internist in dermatology.

Eczema

Eczema is superficial skin inflammation which may be produced by various external irritations, but it always involves a special local or general predisposition, either of the whole skin or of a certain skin organ only, such as the sebaceous glands. Any kind of eczema is dermatitis, but not every dermatitis is eczema. In animals lacking internal eczematous predisposition, dermatitis alone can be induced by external irritation. In animals having special predisposition, eczema will be produced by the same or lesser irritation, or sometimes without irritation.

Eczema presents a complex problem because it involves complete and fundamental internal imbalance of the animal. Eczematous skin changes are often associated with various digestive disorders and various chronic internal diseases. During chronic interstitial nephritis in dogs, eczematous skin lesions appear most frequently in the back region. Eczematous dermatoses are often found on both sides of the neck, shoulder, and trunk during the course of chronic interstitial hepatitis.

Eczemas affecting various species of animals are more commonly associated with malnutrition than they are with a good nutritive state. There have been increasingly frequent reports of eczemas, particularly in dogs, caused by vitamin deficiencies. Research has indicated that fatty acids are of great importance in canine nutrition, and dietary deficiency of this sort may predispose to skin disorders.

Canine eczema often develops from hormonal imbalance. In the male, eczematous dermatoses have been observed in connection with insufficiently developed testicles, in connection with tumors of testicles, and in prostate disorders. Such cases have been treated successfully with testosterone. Conversely, eczema may occur in animals with hyperproduction of sexual hormones. In such instances the application of the opposite hormone or castration has been the most effective treatment.

Hormonal imbalance occurs more often in female than in male dogs. Eczematous der-

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matoses appear in young bitches before the first estrum, during the period of heat, at parturition, or with visible disturbances of estrous cycle. In these observed cases low secretion of estrogen was established, except where the dermatoses appeared in connection

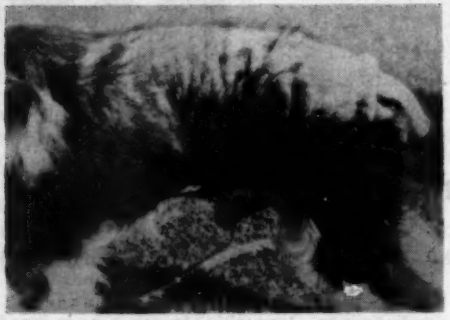

Fig. 1. Eczema associated with chronic interstitial nephritis.

with pseudopregnancy. Cases of eczema have been observed in female dogs after spaying and in course of chronic metritis.

Allergy is one of the most frequent internal factors in the development of various types of eczema. Eczematous skin lesions have been established and artificially produced as allergy, not only by various feeds, but by internal parasites, drugs, proteins, serums, vaccines, antibiotics, and other substances.

Atopic allergy may be produced by various plants, external parasites such as flies, lice, ticks, and externally applied chemicals. Cases of atopic allergy in dogs can be produced by contact sensitivity to petroleum jelly or lanolin which have been used as vehicles in various ointments.

Fungal allergy has etiological significance in trichophytosis, and virus allergy must be considered in connection with several virus diseases such as fibroma molluscum, and canine distemper.

Heredity is another factor in the development of eczematous skin lesions, particularly in dogs.

These predisposing and etiological causes of eczema may act independently without any noticeable external irritation, or they may make it possible for slight external influence to induce cutaneous lesions. Filthy and moist condition of the skin, repeated bathing with irritating soaps, and friction between sweating skin surfaces often lead to eczematous skin changes.

The clinical picture of eczemas is variable, but as a rule they are distributed symetrically over the body surface. Primary and secondary skin lesions may occur in numerous combinations of erythematous, papular, vesicular, pustular, bullous, weeping, squamous, and crustaceous eruptions. In acute eczema, hyperemia and exudation prevail over infiltration. In chronic eczemas, infiltration and squamous crustaceous character predominate. There are certain specific variations in the clinical appearance of eczema not only in character, but also in location and duration of skin lesions, depending on the origin. Canine eczemas of a squamous-crustaceous character and localized around the base of the tail, anus, vagina, between the hind legs, on the scrotum, and on the posterior lower part of the abdomen are usually closely associated with hormonal disorders, involving the gonads, adrenal glands, or hypophysis. Treatment of eczemas in dogs is sometimes difficult. The internal and external origin of eczema necessitates both internal and external treatment. Frequently a change of diet is a significant therapeutic measure. Feeding of raw spleen and liver has been recommended. For internal

Fig. 2. Food allergy evidenced as facial urticaria.

treatment oral, subcutaneous, or intravenous applications of calcium, arsenic, and iodine preparations have been used. Vitamins, especially vitamins A, B, D, and biotin have proved helpful. It is very important to avoid the influence of antivitamins.

In hormonal skin disorders, good results

have been achieved with application of gonadal hormones, castration, or spaying. Hypophyseal hormone and the hormone of the adrenal

Fig. 3. Squamocrustaceous eczema resulting from anal disease in a dog.

cortex have been reported as effective. Stimulation of the reticuloendothelial system and especially of the adrenal cortex by administration of autogenous hemotherapy has been employed in acute and chronic eczemas, particularly when associated with intense itching.

Basic internal treatment of allergic dermatoses in animals requires elimination of cause and immunization with extracts of offending proteins. When histamine-like substances are considered primarily responsible for allergic skin lesions, antihistamines might be applied. Epinephrine, which often essentially relieves the symptoms of pruritic allergy, is considered to be an antihistamine.

In toxic eczemas, good results have been recorded with intravenous injections of sodium thiosulfate.

The choice and application of local treatment should respect one important general principle of dermotherapy. This specifies that each type of skin lesion demands special choice of the proper preparation. It may be necessary to use a different treatment on the moist part of an affected skin area than the one used on the dry part of the same affected area. The continuous use of a given preparation on the same skin area for a long time is not advisable.

Drug Eruptions

In recent years, relatively many cases of thallium poisoning in dogs caused by commercial rat poisons containing thallium, usually thallium sulfate, have been diagnosed. This intoxication may develop either by ingestion or through skin absorption.

In protracted cases, skin lesions develop symmetrically on the legs, particularly in the interdigital area, on the elbow, axillary region, and on the abdomen. The affected parts are denuded, and the skin exhibits symptoms of microgenic dermatitis. In cases of a mild poisoning, loss of hair is the first symptom.

The excessive use of sulfonamides in treating infectious diseases has frequently not only had adverse effects upon internal organs, particularly kidneys, but also has caused cutaneous manifestations. The excessive use of vitamins, especially ascorbic acid, likewise produces disturbances including cutaneous symptoms.

Hypertrophic Changes

Hypertrophic changes of the skin develop in dogs, generally in the scrotum. They are termed scrotal elephantiasis. Another type of the epithelial hypertrophy is psoriasis. It has been diagnosed in dogs and cats but the cause is not known.

Fig. 4. Eczema resulting from deficiency of female hormone in bitch.

Acanthosis nigricans is a type of acquired hyperkeratosis in dogs and cutaneous changes are similar to those seen in man. There is no certainty regarding the origin of the disorder. Its bilaterally symmetrical lesions and its response in some cases to hormonal therapy make it appear likely that the origin is internal

disorder in which disturbed endocrine secretion of the gonads or adrenal glands plays an important part. A recent case of acanthosis nigricans failed to respond with reduction of eosinophiles after application of 25 mg. of ACTH. All other healthy dogs have responded to this test. This has been taken as an indication that adrenal cortex has been deficient. Some practitioners reported acanthosis nigricans in conjunction with infection of the anal glands.

Skin changes of acanthosis nigricans include symmetrically distributed hypertrophy of the papillae, hyperkeratosis of superficial skin layers, and hyperpigmentation of the stratum corneum and stratum germinativum. Excellent results have been described in treatment of acanthosis nigricans by parenterally applied hormones.

Tumors

Skin tumors have developed in small animals, particularly dogs, relatively often. They may be benign or malignant, originating from epidermis, dermis, or subcutaneous tissues. Tumors of dermal appendages originate from hair follicles, sweat, or sebaceous glands.

Horny pads of dogs should be mentioned as benign tumors. They are characterized by horny outgrowths on footpads, having the appearance of typical hyperkeratosis. Their etiological basis is considered to be hereditary. There is no treatment known which insures permanent relief. Excessive growth should be trimmed away.

Warts, cutaneous papilloma, appear in dogs in epizootic form at times. They may develop suddenly, affecting not only skin, but mucous membranes of the mouth, and may cover large areas. They do not seem to be infectious in dogs as has been found in cattle. They develop probably from a hereditary predisposition. Arsenical preparations have been successful in treatment. Fowler's solution given orally daily, or intravenous injections of neoarsphenamines at four to six day intervals are recommended. Vaccine therapy has not been reliable.

Neurofibroma or fibroma molluscum has been reported in dogs in the form of small, superficial, or deeply situated tumors in the skin. They develop spontaneously and there is often spontaneous disappearance.

The most often found malignant tumors in dogs are round-cell or mast cell sarcomas. According to McCleland, one-third of the skin tumors in dogs are round-cell sarcomas. They may occur as single or multiple nodules, rather soft, with poorly defined edges and hairless. Cortisone injections have been used with surprising effect. One hundred grams of cortisone have been administered for nine days intramuscularly. *X*-ray irradiation could also be used.

Tumors of the anal glands have been observed often. These organs are considered specialized sebaceous glands of the perineal region.

Fig. 5. Abdominal fibroma molluscum in a dog.

Tumors of circumanal glands occur clinically as benign or malignant growths. They may start, seemingly, as benign, single, or multiple adenomas, movable, of firm consistency, smooth surfaced, and covered with normal skin. They may turn malignant, assuming nodular, irregular shape, disintegrating on the surface and forming ulcers and fistulae. These are called merocrine and holocrine carcinomas. Prognosis and treatment depend on type, size, shape, and course of development of the tumors. Well defined tumors, without permeation and disintegrating secondary changes, may be removed surgically, however, they sometimes start to grow again. Malignant and holocrine carcinomas are mostly inoperable because of their deep permeation into neighboring tissue. They respond relatively well to *x*-ray irradiation. (500 R every other day for five days; 2,500 R total.) Some practitioners recommend parenteral application of female hormones. Cortisone might also be used.

Virus Diseases

The distemper complex is the most impor-

tant virus disease of dogs associated with skin manifestations. There are two types of distemper complex, the exanthematous form, and hard pad disease.

Exanthematous form is the milder form of distemper and is characterized by pustular, impetigo-like eruptions which develop on the inner surface of the thighs, and on the lower posterior part of the abdomen. Sometimes the lesions form around the nose, eyes, external ear, in the axillary region, and more rarely on the entire skin surface. At first small reddish spots are visible. Soon small papules, vesicles, and pustules develop. The pustules dry into yellowish brown crusts which subsequently fall off, leaving reddish spots. When secondary infection occurs, ulcers may develop as a complication.

Hard pad disease is hyperkeratosis and is considered to be an atypical form of distemper. It is, as a rule, accompanied by fatal nervous symptoms. The initial symptoms may be overlooked, because in the acute stage the pads have an elevated temperature, are shiny in appearance and the pad-epidermis is apparently thinner than normal. Actual hyperkeratotic changes develop in chronic cases showing hardening, which starts peripherally and slowly extends to the center. The disorder usually has a duration of two to four weeks.

Acne

Acne and furunculosis are typical suppurative inflammations of hair follicles and sebaceous glands. They are usually chronic skin disorders occurring in dogs, caused by pyogenic microorganisms, chiefly *Staphylococcus pyogenes aureus*. These microorganisms enter the skin through mechanical irritational skin lesions. Therefore, the lesions occur largely on the bridge of the nose, face, and outer sides of the limbs. In older dogs, a special form of acne and furunculosis develops in the skin between the toes, termed interdigital acne and furunculosis, which sometimes develops into suppurative paronychia. Parenterally applied antibiotics, irradiation with a quartz lamp, and *x*-ray have been effective. Topical use of antibiotics or sulfonamides has not been satisfactory. Treatment results obtained from use of autogenous and polyvalent staphylococcal vaccines have been reported as satisfactory.

Fungus Infections

Cutaneous fungus infections in dogs are canine blastomycosis, canine dermatomycosis and streptothrichosis.

Canine blastomycosis occurs in man and dogs. Kelser observed a type of blastomycotic dermatitis in dogs, which was subsequently transmitted from the dog to two members of the owner's family. In the United States, *Blastomyces dermatidis* has been found causing blastomycoses. Canine blastomycosis develops clinically as two general types: systemic and cutaneous. The cutaneous blastomycosis manifests multiple cutaneous and subcutaneous abscesses, especially on the legs, between toes, and on the head. Skin lesions start as small papules which soon turn into pustules and small abscesses, rupturing to form ulcers. The course is generally protracted and prognosis less favorable. Iodine preparations and antibiotics have been recommended.

Fig. 6. Lesions characteristic of crustaceous ringworm.

In recent years many cases of fungus infections caused by fungi of the genus Trichophyton have been recognized in dogs. They usually appear on the head, neck, and extremities, especially between digits. Skin lesions may be macular, crustaceous, or vesicular, occurring separately or in combination. The crustaceous form is found most frequently, and is characterized by sharply defined scaly lesions. In rare cases, few small papules and vesicles may be present, which break and leave a moist surface, and then develop thick crusted masses.

In some cases of ringworm in dogs skin changes may develop on less hairy parts, particularly in the abdominal and axillary region, resembling the pityriasis rosea found in man and pigs. They are largely macular and vesicular.

Recently, many cases of a dry, scaly form of generalized deep trichophytia in dogs have

been observed. They consist of numerous round or oval, well-defined areas, covered with dry, grayish scales, and having broken hairs. Unpigmented skin of the affected regions shows reddish discoloration and itching is absent. After healing, the hair does not grow because hair follicles have been completely destroyed by the deep inflammation.

In cats, ringworm infections have generally been contracted from dogs or human beings, and in some cases a special type of *Microsporon felinum* has been found. The lesions, which resemble those in dogs, appear on the head, on the lips, neck, and chest. The squamocrustaceous type is predominant. It has also been found that cats are carriers of ringworm infection, even though no skin lesions are clinically visible. The disease may be easily transmitted to human beings.

A mixture of salicylic acid, tannin, and alcohol (5-5-80) has proved effective when rubbed on the affected areas once daily. Commercial preparations may be used. In local treatment of interdigital fungus dermatitis in dogs, formalin in 2% solution is effective.

Streptothrichosis of dogs is caused by *Streptothrix canis* and natural infection takes place through superficial wounds or other lesions of the skin. Cutaneous symptoms are characterized by formation of chronic subcutaneous abscesses. They develop largely in the neck region or on the limbs, but may also occur on other parts of the body, particularly in skin between digits. The affected skin is inflammed and swollen, then abscesses with mucopurulent masses develop. Local cutaneous lesions of streptothrichosis are often associated with pleuritis, bronchopneumonia, or peritonitis. The best treatment is surgical. Good results have also been achieved with *x*-ray irradiation.

Onychomycosis is a special fungus infection of nails, caused by invasion of Trichophyton and Achorion fungi. It has been observed in dogs and cats. The disease may affect one or more of the claws which become rough, brittle, spongy, and uneven. Finally, the whole claw becomes completely deformed. This disorder is extremely persistent and recovery is slow.

Demodectic Mange

Etiologically, demodectic mange in dogs has long been considered to be a genuine infectious disease produced by hair-follicle mites. Recent research has shown, however, that Demodex mites, as such, appear to be of little consequence in animals in a perfect state of health. It is not until the animal is subjected to devitalizing factors, such as nutritional deficiencies, internal parasites, and systemic disorders, that these parasites become a serious problem to the animal.

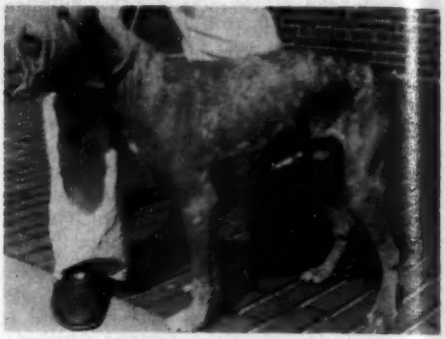

Fig. 7. Generalized squamocrustaceous form of demodectic mange.

Only under such predisposing conditions can hair-follicle mites and bacteria bring about development of demodectic mange. This viewpoint is based upon failure to produce the disease by placing mites upon the skin of healthy animals, or by exposing the sound

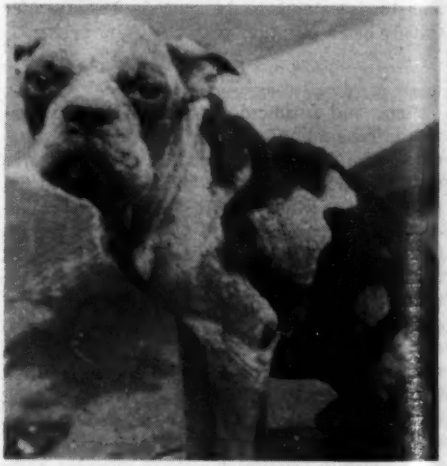

Fig. 8. Pustular form of demodectic mange.

animals to diseased individuals. Further evidence is that hair-follicle mites are found on healthy dogs and other animals without producing skin lesions. Trautwein found demodectic mites in the hair follicles of the skin of the eyelids and lips of dogs that exhibited no skin lesions. Unworth reported follicle mites in the skin of the eyelid and nose in 10% of healthy dogs.

From a pathogenic standpoint, when mites find themselves on an animal which offers a favorable medium, they penetrate hair follicles, destroy root sheaths and papillae, and later the sebaceous glands. As a result of mechanical and possibly toxic influences the hair follicles are gradually enlarged, the epithelial lining of papillae atrophy, and hairs break or fall out. Kusher in Vienna reported unusual cases of demodectic mange in dogs, in which he found another mite, *Cheyletiella parasitovorax* feeding on and thereby destroying demodectic mites.

Initial symptoms of demodectic mange in dogs often are such as to make differential diagnosis difficult. Cutaneous lesions develop slowly and may assume a variety of characters. There are four fundamental forms of follicular mange occurring in dogs: squamous, squamopapular, pustular, and atypical. There may be other individual variations in appearance not

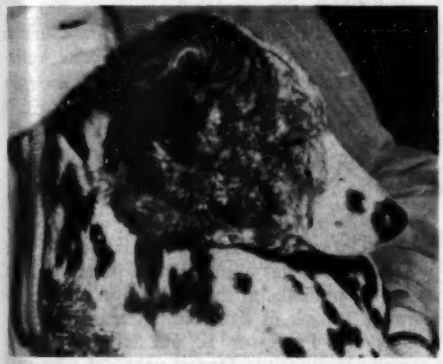

Fig. 9. Phlegmonous form of demodectic mange.

only with regard to character and distribution of skin lesions, but also with respect to severity and course of the disease. In some cases, cutaneous lesions are limited to the head region throughout the entire course. In others the disorder may extend over the whole body surface.

Lesions limited to the head for long periods may extend within a few days over large areas of the body. The squamous form of follicular mange shows all the symptoms of a squamous eczema. Lesions begin as small patches on the forehead, nose, lips, occasionally on legs, and more rarely on the trunk. There is loss of hair, resulting in sharply defined bald spots, resembling alopecia. Affected skin is reddish and soon is covered with small bran-like scales. Hair bordering bald areas can be pulled out easily, and shafts are surrounded with scales in a manner suggesting the squamous form of trichophytia. Loss of the hair continues gradually, redness of the affected skin deepens to a copper color, the skin becomes thicker, rough, and cracked. The squamous form may either remain as such, or may develop into the squamopapular or pustular form.

The squamopapular form of demodectic mange appears when small papules develop on the squamous form. As a rule there is no itching, the course is chronic, lasting for months or even years. When lesions heal, there is often increased pigmentation in affected skin and hair.

The pustular form usually develops on the same cutaneous regions as the squamous type. It may develop from the squamous form, but sometimes it has independent origin. It is characterized by purulent inflammation of the hair follicles and sebaceous glands, and resembles acne or furunculous nodules. At first the affected skin is swollen, hyperemic, and has elevated local temperature. Soon after this, numerous small papules develop which turn into bluish, red, or yellow pustules in which are found pus, and sanguinous discharges, and demodectic mites and their eggs. The skin becomes thicker and is thrown into thick folds. The cutaneous surface is covered with brownish-gray crusts and scales.

In severe and advanced cases of pustular demodectic mange, particularly when there is secondary infection with necrotic bacilli, skin is more swollen, and there may be ulceration or gangrenous changes. Skin lesions may become dry but after a time new papules and pustules may occur and the process begins anew. Itching is sometimes absent, however, in some cases the itching has been pronounced. In advanced cases, when the cutaneous lesions involve large areas and invade deeper tissues, there is emaciation and the animal dies from septicemia or cachexia.

The atypical form of follicular mange in dogs is characterized by skin lesions which are dispersed over the body. Hair falls out in large, sharply defined, irregularly shaped areas. Skin itself shows papules, pustules, and weeping spots resembling moist eczema. In this form there is no apparent itching. According to the statistics of Unsworth, 86% of the cases of demodectic mange were uncomplicated, while 14% were complicated as a result of bacterial invasion. In 55% of all the animals the lesions were confined to the head.

The course of demodectic mange in dogs is always chronic, the prognosis depending on a

variety of factors. In severe and advanced cases permanent recovery is rare. Sometimes the lesions may break out several weeks after apparent recovery. There are cases, however, in which there is spontaneous recovery without treatment.

In treating demodectic mange in dogs, therapy includes not only antiparasitic measures and care of the local skin lesions, but also attention must be given to improving the general health of the animal.

In some cases, considerable improvement has been noted following dietary adjustments in which there was a high protein and vegetable content. With younger animals calcium, magnesium, arsenic, phosphorus, and vitamin preparations should be administered orally or by injection. Antiparasitic treatment may be provided either generally or locally. Systemic antiparasitic therapy with arsenic preparations are administered orally or by injection. Kirk recommends subcutaneous injections of phenamidine, a drug used to treat babesiosis. Kirk reported the complete recovery of demodectic mange in dogs without local treatment. Möcsy treated demodectic mange affecting large skin areas with oral administration of contact poisons (di-trichlorphenyl-dichlorpropan) in four daily doses of 0.1 gm. for every 2 lb. body weight. After an interval of one week treatment had to be repeated. In cases of pustular demodectic mange, antibiotics, topically and intramuscularly combined, have proved effective.

Many preparations have been recommended for local treatment of follicular mange. For treating early cases of squamous type very gentle application of alcoholic and oily preparations is advisable. When squamous, crustaceous non-pustular mange is chronic, more drastic medication should be applied. French veterinarians recommend that diseased skin be first scarified, then rubbed with tincture of iodine. German veterinarians suggest rubbing into diseased skin a combination of tincture of iodine, formaldehyde, and ether in ratio of 1-2-3. Russian, French, and Indian veterinarians reported good results with the Demianowitsch method by fumigation with sulfur dioxide (SO_2) generated in *statu nascendi*. Various commercial preparations have also been employed.

Considering the relatively complicated treatment of different types of follicular mange it is not advisable to use the same treatment throughout the entire course. On the contrary, medication should be changed in conformance with the character of the skin eruptions and response of the affected skin areas.

Ear Vein of Cattle as an Injection Site

Dr. M. R. Marathe (*Indian Vet. Jour.*, Sept. 1952) outlines advantages of the ear vein for intravenous injection in cattle. He and his colleagues have used this technic in many cases, and consider it advantageous and superior for the following reasons:

1) Injection can be made in standing position in animals that might otherwise need major restraint.

2) Considerably less assistance and restraint is needed, and the animal can be released immediately after injection, if desired.

3) Operator himself can observe patient's breathing in anesthetized cases.

4) Vein is not mobile and puncture is facilitated. The vein is fixed less firmly near the base of the ear.

5) Extravasation is easily detected and position of the needle corrected.

6) Skin is thin and tender and puncture is easily done. A thick needle also works well.

7) In event of extravasation, no vital organ is affected, and the ear could be cut off if necessary. Difficulties are rare, however.

The site is equally advantageous for withdrawal of blood samples.

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The Cornell Research Foundation, in the public interest, has applied for a patent on the use of propionates in the prevention and treatment of ketosis in dairy cattle, a process developed by Professor L. H. Schultz of the Cornell University Department of Animal Husbandry. Licenses for the use of the Schultz patent application are available from Research Corporation, a non-profit foundation, at 405 Lexington Avenue, New York City.

The treatment consists of administering salts of propionic acid in amounts of from a quarter pound to one pound daily, either in capsule form, as a drench, or mixed with feed for a period of about ten days.

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F. R. Koutz, H. F. Groves, and R. E. Rebrassier, in an article titled Parasites or Pseudoparasites? (*Speculum*, 6:7, 1952), recount their experiences with specimens submitted as parasites. The spinal cord of a trout, arteries, nerves, earthworms, horsehair worms, mucous membranes from croupous enteritis, strings, rubber bands, seeds, plant fibers, plant cells, pollen buds, and pine pollen have been submitted for identification.

The Clinical And Some Pathological Aspects Of Pancreatic Disease In Dogs†

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DIAGNOSIS and treatment of diseases arising in the abdominal cavities of dogs present many difficulties. Some of these problems arise because subjective appraisal of the location of pain or discomfort cannot be elicited. Also, lack of cooperation on the part of the patient prevents muscular relaxation which is a prerequisite for proper palpation of the abdomen.

Another difficulty in diagnosis and treatment results from the diagnostic term "enteritis" or "gastroenteritis" which appears to be overpopular. To interpret the symptoms arising from the body cavity it is necessary to recognize signs that accompany malfunction or deficiency of the various abdominal organs or systems and associate these with underlying pathologic-physiologic alterations. When a diagnosis is made by these rational methods, a firm basis for prognosis and treatment is established.

To achieve this goal a clinicopathologic study of diseases of various organs in the abdominal cavity of dogs is underway in the Department of Pathology at the Angell Memorial Animal Hospital. The organ under consideration in this paper is the pancreas.

Anatomy

The pancreas is a compound gland having two secreting portions, an internal and an external. It is a composite of two unrelated organs associated in the same stroma. (In teleost fish, the internally secreting island cells are entirely separated from the externally secreting acinar pancreas.) The continuity of the tissue makes it impossible to view one portion without the other. Therefore, it is appropriate to discuss the organ as a single unit.

In dogs, the pancreas is a boomerang-shaped gland. One limb is attached to the duodenum, the other floats free in the omentum in a transverse plane. The duct which conveys the enzyme from the externally secreting portion enters the duodenum about 1 cm. posterior to the bile duct. A small accessory duct, not found in all dogs, joins the duodenum at or near the biliary papilla. The pancreas is attached to the duodenum and is adjacent to the liver and spleen, to which adhesions may form after recovery from pancreatic inflammatory disease.

Physiology

The exocrine function of the pancreas is secretion of pancreatic juice, which contains three enzymes: trypsin (protein-splitting), pancreatic diastase or amylase (starch-splitting), and lipase (fat-splitting). The juice is strongly alkaline due to the presence of bicarbonate ions. This fluid is excreted in considerable volume, approximately 2 to 4 cc. per. kg. of body weight each hour during active stimulation. The three enzymes, together with the necessary bicarbonate ions, make up the functional components and are active in the total digestive process. The endocrine function of the pancreas is the secretion of insulin into the blood which acts in the utilization of glucose and glycogen.

Case Material

Approximately 70 cases of all types of pancreatitis have been collected from over 1,800 autopsies performed at the Angell Memorial Hospital from 1946 to the present date. Forty-five of these, yielding sufficient data, are tabulated in table I and form the basis for this report. These have been subjected to a thorough pathological study which will be reported elsewhere[2]. Clinical studies had previously been made on these cases[1]. This paper presents a discussion of the practical aspects

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†Portions of this paper were presented at the New York City Veterinary Medical Association in January 1950, at a special lecture at the University of Pennsylvania in February 1950, and at the 23rd annual meeting, Florida State Veterinary Medical Association, West Palm Beach, October 27-28, 1952.

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of the work which we feel will be of value in small animal practice. The diagnostic features of this study have been summarized previously[2].

Description of the Disease

It is possible to classify our cases of pancreatic disease into four types which present distinctive clinical and pathological pictures.

Acute Necrotic Pancreatitis. The typical case of acute necrotic pancreatitis appears in obese animals, is of sudden onset, and is marked by symptoms referable to abdominal pain or peripheral circulatory collapse. Usually these are increased tenseness of the abdominal wall, tenderness in the epigastrium, disinclination to move, and sometimes, shallow respirations with rapid pulse. Epigastric pain may be extremely intense and may be manifested by the unnatural position which the animal assumes. This consists of standing on its hind legs and extending the front legs so that the chest is on or near the floor, suggesting an attitude of prayer. The body temperature is elevated in the early stages but frequently is depressed below normal as collapse develops. There may be moderate leukocytosis. Sedimentation rate is usually slowed or normal. Frequently, there is hemoconcentration. If the case persists for some days, there will be elevation of blood sugar due to destruction of the island-cell tissue. Shock or hemoconcentration may raise urea nitrogen and creatinine levels terminally.

Changes in acute necrotic pancreatitis are essentially the result of action of the pancreatic enzyme which for some reason, becomes activated within the gland, causing autodigestion or necrosis of the gland and adjacent fat. This results in a swollen, edematous or bloody organ containing foci of whitish, necrotic fat in peripancreatic tissue and, sometimes, throughout the body cavity. The entire organ may be affected but, occasionally, alteration is confined to either one or both limbs, but spares the center. At times the center is affected and terminal portions of both limbs are spared. Histopathological data will be presented in detail elsewhere[1]. There is, essentially, necrosis, hemorrhage, and cellular infiltration.

Chronic Pancreatitis. Chronic pancreatitis is less fulminating; the typical case has a gradual onset in an obese dog. Frequently, polydipsia or polyuria are the first signs noted. In other cases, symptoms referable to digestive disturbances, consisting of ravenous appetite or, sometimes, anorexia mark the onset. Abdominal bloating, flatus, or other symptoms of deficient digestion may also occur. A number of cases show diarrhea with fetid or fatty stools. In several cases, histories of illness corresponding to acute necrotic pancreatitis were elicited one month prior to admission. In these cases, apparent recovery was followed, in a few weeks, by polydipsia, polyuria, poor appetite, and weight loss. In general, symptoms referable to an increased water excretion and thirst, as well as glycosuria and elevated blood sugar (diabetes mellitus), are to be expected. Chronic pancreatitis is thought to be the healing and scarring phase of acute necrotic pancreatitis that has survived the initial phase.

Some dogs appear to be predisposed to pancreatitis. These exhibit recurrent attacks of indigestion with apparently normal intervening periods. They are, we believe, subject to repeated, minor attacks of acute pancreatitis each of which is followed by a chronic sequence. Consequently, there coexists, in the pancreas of such animals, varying stages of acute and chronic forms of the disease. For this type of the disease we employ the term chronic relapsing pancreatitis. If such cases do not succumb to acute attack they will eventually die of the chronic form when sufficient tissue has been destroyed.

The gross pathologic alteration in chronic pancreatitis is shrinking and distortion of the pancreas, making its recognition difficult except by careful palpation. In these cases, only a small, distorted nodule of pancreatic tissue may be located in the region of the juncture of the pancreatic duct and the duodenum. The mesentery may be distorted and adherent to the liver or other adjacent structures and, usually, the duodenal lymph node is incorporated in the fibrotic mass. Sometimes a portion of virtually normal pancreas will remain while the rest of the organ is destroyed or visibly scarred. The liver is fatty. The kidneys are softer than normal and slightly swollen.

The histopathological alteration in chronic pancreatitis is one of massive fibrosis which eventually leads to destruction of functional tissue by compression of contracting collagen. Areas which escape this degenerative process may present a normal pancreas although there may be an increase in interlobular connective tissue in these areas as well. The liver shows centrolobular fat infiltration with a development of perilobular fibrosis which sometimes results in death from liver failure in long-standing cases. Renal tubules contain an ex-

[1]Appreciation is due various members of the clinical staff at the Angell Memorial Animal Hospital who have contributed to this project.

cess of fat. If the animal dies of chronic relapsing pancreatitis, evidence is found of acute focal necrotic pancreatitis together with scarring from previous attacks.

Pancreatic Fibrosis. In pancreatic fibrosis, the symptoms are usually similar to those of chronic pancreatitis though the condition appears to be of more gradual onset and animals are less likely to show signs referable to diabetes mellitus (hyperglycemia and glycosuria). Animals are not obese at the time of admission and do not have a history of previous obesity.

Pancreatic fibrosis presents a symmetrical reduction in overall thickness of the gland over its entire length. There are no massive scars or adhesions. Histologically, the earliest cases show fibrosis around the ducts as well as in interlobular and intralobular tissue and there is no acute inflammatory reaction. Most severe cases show striking alteration with hyperplasia of both interlobular and intralobular connective tissue. Ducts are normal and surrounded by dense hyalinized collagenous tissue. Severe fibrosis may lead to complete obliteration of acinar tissue; the whole organ being reduced to a fibrotic mass containing lymphocytes and relatively abundant nerves and blood vessels. In certain of our cases pancreatic islands were detected even though all signs of acinar tissue were lacking.

Collapse or Atrophy of the Pancreas. The fourth pancreatic syndrome results from complete loss of acinar function with apparent sparing of island-cell function. The symptoms, therefore, are the result of almost total digestive failure accompanied by normal glucose metabolism. The characteristic animal is in a poor nutritional state, has a ravenous appetite, large abdomen, and massive, granular, fatty stools. Coprophagy is common. The animal's attitude is dejected. In two of our cases, histories referable to acute febrile illness prior to appearance of digestive symptoms were obtained. This suggests that the condition may be the result of an infectious process.

Gross changes in the abdominal cavity are characteristic. Abdominal fat is completely absent. The colon and intestine are remarkably hypertrophied. The pancreas has normal length and width but is reduced to a millimeter or less in thickness. It resembles a film of red lace; bright pink and easily transilluminated. The microscopic appearance is one of undifferentiated cells with no acinar pattern. Larger ducts are completely normal and patent. There is a slight infiltration of lymphocytes in the fibrous stroma surrounding the ducts.

Diagnosis

Diagnosis of pancreatic disease is based on evaluation of history, clinical symptoms, and laboratory findings. In acute necrotic pancreatitis symptoms consist of pain, bloating, vomiting, and bloody diarrhea. There is remarkable relationship of both acute and chronic forms to obesity, as shown in table I. After the first few days, symptoms of pain may subside and the animal may be only in shock. Frequently, by the time the dog is brought to the veterinarian there will be glycosuria and elevation of blood sugar. Acetonuria is often present and may be detected by the odor of the breath.

Usually, in all forms of pancreatitis there is increase in fat in the stool. The feces may be abundant, as in acinar atrophy or collapse, or relatively scanty as in chronic pancreatitis. Sometimes the oil is emulsified into fine globules, giving a whitish, foamy appearance to the stool (steatorrhea). In other cases, oil exists as fluid oil which flows from the specimen when deposited on a smooth surface (in acinar atrophy or collapse). Occasionally hair of the perineal region is stained by oil that escapes from the anal sphincter, even though the stool appears normal. Fat is usually not present in great amount in stools from either acute or chronic pancreatitis if the appetite is diminished. The stools fre-

TABLE I. Tabulation of 45 Cases of Pancreatic Disease

	No. cases	Obesity	Aver. age (yr.)	Aver. dur. disease (days)	Cases steat.	Urinalysis No. exam.	Urinalysis Sugar	Urinalysis Albumin	Blood Sugar No. exam.	Blood Sugar Elevated	Blood Sugar Average mg. %
Acute necrotic pancreatitis	14	9	7.6	5.2	1	6	3	6	2	2	243
Chronic pancreatitis	19	10	8.0	4.8	8	7	7	0	7	7	323
Pancreatic fibrosis	5	1	6.6	24	2	2	0	1	2	0	84
Atrophy of acinar tissue	5	0	1.5	116	5	2	0	0	3	0	80
Miscellaneous	2	0	4.3	32	1	2	2	0	2	2	200

quently appear to be composed mostly of mucus. Such specimens often emit an odor of rancid fat which may be described as a "piggy odor".

Microscopic inspection for fat is useful but, at times, misleading. The technic consists of mixing a small portion of feces with water and a few drops of saturated solution of Sudan 3 or 4 in equal parts of 70% alcohol and acetone. This causes the fat droplets to stain red and differentiates them from other circular objects. The examiner must realize that healthy animals excrete fat in their stools and even animals on fat-free diets may also excrete considerable amounts of fat. Therefore, it is only with care that minor degrees of steatorrhea may be distinguished from the normal contents of the stool.

The typical stool also contains starch granules and undigested muscle fiber; the latter being useful as an index of pancreatic deficiency. When there is impairment of digestion, muscle fibers appear to have square-cut ends and their cross striations are preserved. Staining the stool with Lugol's solution or tincture of iodine will make the muscle fibers more recognizable. Iodine will also stain starch granules if they are present.

Specific Tests for the Detection of Pancreatic Dysfunction

Vitamin A Absorption Test. This test is based on the principle that the vitamin A in oleum percomorphum can be absorbed from the intestine only in the presence of pancreatic lipase. Therefore, if there is diminished absorption, a deficiency of the exocrine portion of the pancreas may be expected.

The procedure is as follows: (1) Prepare the dog by giving a normal evening meal, then withhold food the following morning. (2) Take a pre-administration blood sample for serum and then administer, *per os,* oleum percomorphum at the rate of 0.1 cc. per lb. of body weight. (3) Take the second blood sample three and one-half hours after administration of the oleum percomorphum and the third sample three and one-half hours later (seven hours after administration).

TABLE II. Average Values for Serum Vitamin A

	Pre-admin. sample	3½ hour sample	7 hour sample
Normal animals	68.8	159.7	287.5
Pancreatic deficient animals	23.3	28.8	30.6

The blood sera are separated from the clots in the three samples and the sera are then analyzed for the presence of vitamin A[a]. In the normal animal, the serum vitamin A in the second sample should be two to three times above the pre-administration level. The third sample should be three to six times above the first sample (fig. 1). The animal with total exocrine-secretion deficiency will show an increase in serum vitamin A of one to one-and-one-half times the pre-administration level. In the partially deficient, an intermediate elevation will occur.

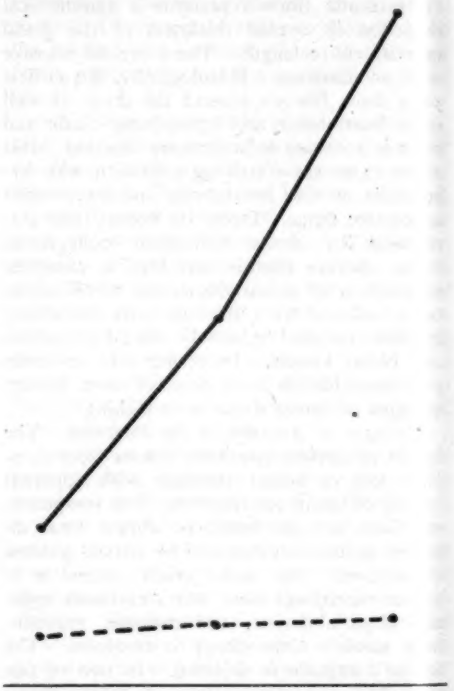

Fig. 1. Graph representing increase in serum vitamin A expressed in units following the administration of oleum percomorphum at the rate of 1/10 cc. per lb. of body weight. Solid line represents normal animals, dotted line, pancreatic-deficient animals.

Pancreatic Extract Test. This clinical procedure requires no laboratory work. It is based on the fact that improvement in digestion will occur in cases of exocrine deficiency after the administration of viokase® or other potent pancreatic extract. One week, usually, is sufficient time to evaluate results if the animal is placed on such a regimen. There will be an

®Viobin Corp., Monticello, Ill.

improvement in the character of the stool almost immediately if the condition arises from pancreatic disease.

Oleum Percomorphum-Pancreatic Extract Test. This test will differentiate between chronic intestinal disease and specific failure of pancreatic lipase as the causative agent of faulty fat absorption.

The procedure is as follows: (1) Perform the oleum percomorphum test as described above. If the test shows failure of absorption, repeat the test, administering ten to 30 gm. of pancreatic extract when giving the oil and again in three and one-half hours when the second blood sample is taken. If there is appreciable increase in absorption of vitamin A following the combined procedure it indicates that deficiency of pancreatic lipase was responsible for absorption failure after the administration of the oil alone (fig. 2). If there is little or no increase in serum vitamin A, it suggests that failure of absorption is due to some factor not related to pancreatic disease.

Differential Diagnosis

Acute pancreatic necrosis or acute exacerbation of chronic relapsing pancreatitis must be differentiated from infectious canine hepatitis, acute nephritis, collapse from intestinal obstruction, intussusception, or other acute abdominal conditions[9].

In acute nephritis, pain is elicted more often from pressure over the loin than from the abdomen. There is usually significant elevation of the urea nitrogen of the blood as well as a urine picture characteristic of nephritis, with sediment consisting of cells, casts, and albumin. An ammoniacal odor to the breath is frequently detectable.

In infectious canine hepatitis, there is often pain in the abdomen somewhat resembling pain from acute pancreatitis. In hepatitis, however, pain is evinced only when deep pressure is applied, and there is not the overall tenseness of the abdominal wall. Icterus may be present in either condition but is more likely to be found in hepatitis. The blood picture is quite different in hepatitis. There is a well-developed leukopenia and increased sedimentation rate. In acute necrotic pancreatitis, on the other hand, the number of leukocytes is normal or elevated and there is no change in sedimentation rate.

In other acute abdominal diseases, the clinical symptoms are essentially the same as those of acute necrotic pancreatitis. The animal vomits, has bloody stools and abdominal pain coupled with collapse. However, by the time the veterinarian sees any of these cases the disease has usually progressed to the point where differential diagnosis is less difficult. In the presence of pancreatic necrosis there will be elevation of blood glucose and glycosuria

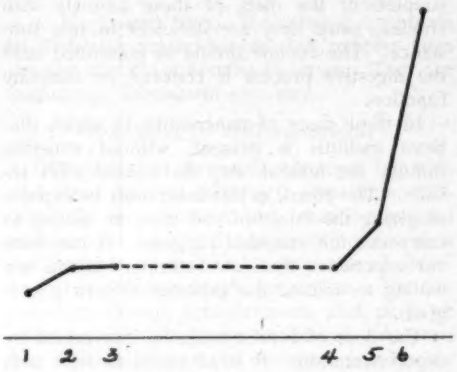

Fig. 2. Graph representing serum vitamin A levels following oleum percomorphum administration in a pancreatic-deficient dog. 1, 2 and 3: administration of oil alone; 4, 5 and 6: administration of oil and pancreatic extract on the following day. Note the marked differences in the absorption curves.

and a number of the cases will have enough acetone odor to the breath to be detectable clinically. It is our impression that the pain in the early phase of acute pancreatitis is much greater than pain in other canine abdominal catastrophies.

Treatment

Treatment in acute pancreatitis consists of various supportive measures which are necessary in order to maintain tone of the circulation until natural repairative forces have come into sufficient operation to maintain the animal's life. If enough pancreatic tissue is destroyed by primary necrosis and inflammation, there will be insufficient function of the exocrine and endocrine portions to support life. However, these animals may survive a sufficient time to develop marked steatorrhea as well as severe symptoms of diabetes mellitus. When exocrine and endocrine deficiencies coexist, it is only possible to sustain life by perpetual administration of both insulin and pancreatic extract, inasmuch as regeneration of neither tissue will take place. Few clients are willing to continue such a regimen indefinitely.

In cases of pancreatic fibrosis, in which there is minimal deficiency of pancreatic island

tissue, and in all cases of pancreatic acinar collapse or atrophy in which there is no island-cell deficiency, animals can be maintained by administration of pancreatic extract in the diet. We have used the pancreatic extract viokase at the rate of 10 to 30 gm. per day administered with the main meal. It is beneficial to supplement the diets of these animals with choline, since they are deficient in this substance. The choline should be continued until the digestive process is restored to adequate function.

In those cases of pancreatitis in which diabetes mellitus is present, without exocrine failure, the animal may be treated with insulin. The client, in this case, must be capable of giving the injection and must be willing to carry out the extended regimen. It has been our experience that few veterinary clients are willing to assume the expense of such a program.

The dose of insulin must be determined by experimentation. It is advisable to start with a small dose: 10 to 40 units per day. Meanwhile, the changes in sugar content of the blood and urine must be appraised. The quantity of insulin can then be prescribed to maintain the blood sugar at a level slightly higher than normal. The proper dosage of insulin will yield a faint trace of sugar in the urine. It is imperative that the client understand the importance of keeping the animal's diet constant in quantity and content.

Summary

Collapse is the primary symptom in acute necrotic pancreatitis, accompanied by severe abdominal pain, vomiting, and bloody diarrhea. It usually occurs in obese animals. Glycosuria, polyuria, and hyperglycemia are often present.

The symptoms in chronic pancreatitis are gradually evinced. They may be referable to digestive failure (steatorrhea) or to insulin deficiency (glycosuria, hyperglycemia, polyuria, and polydypsia). Fat animals are also found in this group.

Pancreatic fibrosis displays no predominent symptoms. However, symptoms relating to digestive failure or, occasionally, to functional failure of island cells occur.

Symptoms in pancreatic acinar collapse or atrophy are those of marked digestive failure unaccompanied by pancreatic endocrine failure. The animals present an emaciated condition with enlarged abdomens and relaxed musculature. The stools are copious and coprophagy is common. A peculiar dejection in the state of morale is evident.

Pancreatic diseases can be identified by conjoining clinical examination with laboratory tests. The most useful tests are microscopic examination of the stools, blood-sugar determinations, and urinalysis. Clinical trial with pancreatic extract may be performed and the vitamin A absorption test is useful in doubtful cases.

Treatment is successful when the diets are supplemented in animals suffering from pancreatic collapse or atrophy and also in some cases of pancreatic fibrosis. Due to the complex nature of the supplementation required for treatment of animals having a deficiency of both exocrine- and endocrine-secreting pancreatic tissue, the success of the regimen depends largely on cooperation of the client.

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A drug has two major features: (1) intensity and (2) duration. These features are intertwined and necessarily influence the quantity of the drug to be used. These are not mere academic considerations, but are of practical importance.

Intensity variances are thus seen as threshold effect, peak effect, and maximal effect. Duration likewise varies by such qualifications as latency time, peak time, and persistency time. It is particularly important in reference to the short acting antibiotics and the so-called "repositols". The results derived from a host of investigations on repository agents are surprisingly indefinite in terms. A clear definition of end points is needed so that suitable confidence limits are accomplished. — *Proc. Soc. Exp. Bio. Med.*, 81:596 (Dec.), 1952.

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Marcus M. Mason and Albert M. Scheflen (*Cornell Vet.*, 53:1 [Jan.], 1953) in examining neuropathological changes in the brains of nine senile dogs, found changes comparable to senile changes in human psychotics. There were neuron changes, perivascular hemorrhages, gliosism, acellular areas, fibrosis, and neuronophagia. The authors state that since the changes are non-specific and occur with anoxia at any age, they doubt if the neuropathology of senility has been discovered.

Infectious Canine Hepatitis†

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INFECTIOUS canine hepatitis is one of the major virus diseases of dogs. Apparently it has been widespread for many years, complicating cases of distemper and other acute infections in young dogs. It has been called fox encephalitis, but this is confusing since no nervous symptoms are observed in uncomplicated cases. The same virus causes both fox encephalitis and infectious canine hepatitis. The predominant symptom in foxes is encephalitis; in dogs the liver and blood vessels are affected.

The disease is chiefly observed in dogs three to eight months of age, less frequently in older animals. It has no breed, sex, or seasonal incidence. Puppies of certain litters appear to be resistant, while those of others are highly susceptible. Often, the healthiest and liveliest are those most severely affected.

Although the disease may vary clinically, uncomplicated infection may exhibit one of the following forms:

1. Fatal fulminating. An apparently healthy dog may collapse and die in 12 to 24 hours. Before death, body temperature is elevated to 105-106 F.; pulse is rapid, narrow, and soft, with small amplitude; mucous membranes are pale; oligemic shock is present and subsequent autopsy findings characteristic.

2. Severe non-fatal. Temperature 105-107 F., often with no noticeable ill health; tachycardia is present and peripheral pulse diminished, soft and narrow; malaise and severe leukopenia are typical findings. The tonsils are enlarged and congested. Abdominal tenderness is common in the xiphoid region and there may be corneal opacity. If no bacterial complications develop, recovery may follow in six to eight days. Diffuse keratitis is found in about 30% of the cases, and may occur in one or both eyes seven to ten days after the acute symptoms subside, persisting for about a week.

3. Mild form. There is slight clinical illness usually not recognized by the owner; temperature moderately elevated; moderate lethargy and anorexia; photophobia with serous eye discharges.

4. Inapparent form. No clinical symptoms of ill health are noticeable, but puppies later develop specific antibodies in serum. They are immune to subsequent exposure.

Problems of Differentiation

Differentiation between infectious hepatitis and other diseases of dogs is sometimes difficult. In an individual dog showing general malaise and no specific signs of illness, it is not possible to confirm a diagnosis of infectious hepatitis by simple inspection. Distemper, leptospirosis, toxoplasmosis, and, perhaps, other conditions must be considered. At present, differentiation from distemper is probably most important.

In initial stages of illness, infectious hepatitis and distemper may present similar signs. Knowing whether the animal previously had been immunized against the virus of Carré can make it possible to eliminate distemper from consideration. In the usual case of infectious hepatitis, there is tendency for the leukocyte count to be less than 4,000, while in distemper it is usually higher. Variations in both diseases make critical differentiation impossible. Observation over several days may provide important information. Classically, distemper presents a diphasic temperature curve, with corresponding leukocyte changes, whereas in infectious hepatitis, the leukopenia is marked and temperature fluctuates.

If the animal is one of a number in a kennel, history becomes important. In distemper, all susceptible dogs will show signs of illness in a relatively short time, since this infection is airborne. The virus of infectious hepatitis does not spread by the air route and apparently requires either food contamination or some other means of entrance into the mouth. As a result, infection spreads slowly, especially in kennels where good sanitation prevails. Sequelae that ordinarily occur with distemper usually are not seen in infectious hepatitis. Another helpful differential feature is the development of corneal opacities after subsidence of acute signs. This has not been seen in animals with experimental distemper.

In some instances, leptospirosis may present a problem in differentiation, especially when jaundice is absent. When present, jaundice

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†Presented at the 23rd annual meeting of the Florida State Veterinary Medical Association, West Palm Beach, October 26-28, 1952.

*Veterinary Medical Department, Pitman-Moore Company, Indianapolis, Ind.

usually indicates leptospirosis or some condition other than infectious hepatitis. When jaundice is absent and signs of illness do not differentiate, dependence may be placed on the leukocyte count, which is increased in leptospirosis and decreased in infectious hepatitis.

Toxoplasma may create symptoms of general malaise and high fever, but there is usually marked local enlargement of lymph nodes, and severe depression. Actual demonstration of the organism may be necessary.

The rapid death of one case, with acute loss of blood, petechial hemorrhages on gums, shock, and icterus, are signs suggesting leptospirosis. If severe gastroenteritis is present, it suggests hemorrhagic gastroenteritis, commonly seen in Greyhounds. If, however, on section, a thick gall bladder wall and nuclear inclusion bodies in hepatic parenchyma are demonstrated, the condition is definitely infectious hepatitis. This disease should be considered when dealing with isolated cases tentatively diagnosed as distemper or with high temperatures of unknown origin.

Sporadic cases are easily overlooked because of the inconspicuous nature of illness in mildly affected animals. Infection, with later recovery, is possible and, undoubtedly, rather common.

The acute symptoms and rapid course of infectious canine hepatitis may be confused with poisoning, anaphylactic shock, leptospirosis, heart failure, distemper, and toxoplasmosis.

Method of Virus Spread

The virus of infectious canine hepatitis can be spread by (1) the transfer of saliva on finger tips, and (2) the urine of dogs which have apparently recovered from the disease.

Although not airborne, this disease is highly infectious. It spreads easily by contact, and susceptible dogs placed with infected ones become infected. Transmission does not occur when kennel units containing infected and susceptible dogs are separated by a distance of two feet or more.

Prophylaxis

It has been found that the virus of Carré and the virus of infectious canine hepatitis may produce infection in the dog simultaneously or in other time sequences. The administration of serum from dogs hyperimmunized against both viruses, at the rate of 0.5 cc. per lb. body weight will provide immediate passive immunity against both viruses for about two weeks. For active immunity, intradermal injection of infectious hepatitis vaccine, a killed liver tissue vaccine, in 1 cc. doses produces adequate protection. Active immunity against both infectious canine hepatitis and distemper can be produced with the simultaneous use of infectious hepatitis vaccine intradermally, and virovax,® distemper vaccine chick embryo origin, or virogen® subcutaneously.

Treatment

Since the viruses of distemper and canine hepatitis may produce infections in the dog at the same time, the use of duo-sera® is indicated in cases of high temperature of unknown origin in a young dog. Used in doses of 0.5 cc. per lb. body weight, preferably intravenously, it is most effective in the early stages. Other therapeutic agents should be employed as indicated. Transfusions of whole blood, preferably from an older dog, are often useful.

Autopsy Findings

Pathological findings vary with the acuteness of the disease. The following may be present: Thickening of the gall bladder wall is pathognomic. Liver is enlarged and nutmeg in appearance, friable, and dryer than normal on section. There may be hemorrhages on the outer surface. Inflammed swollen tonsils are commonly found. Lymph nodes are enlarged, moist, and hemorrhagic, particularly in the abdomen. A thin, clear fluid, light yellow to dark brown, is found in the abdominal and chest cavities. Hemorrhagic enteritis, often with free blood, is typical in the small intestines. Petechial hemorrhages are found on surface of lungs.

Microscopy demonstrates characteristic intranuclear inclusion bodies in the parenchymatous tissue of the liver and endothelial cells of blood vessels. The pathological anatomy (vascular insufficiency and tendency to edema) resembles changes characteristic of shock.

While a typical autopsy reveals rather characteristic gross tissue changes, histologic examination often is necessary for differentiating infectious canine hepatitis from other conditions such as leptospirosis and distemper. Intranuclear inclusion bodies are present in the liver cord cells.

Practical Considerations of Infectious Hepatitis

1. Allowing for variations on the part of individual dogs, the incubation period is the same as that of canine distemper.

(Continued on page 204)

®Pitman-Moore Co., Indianapolis, Ind.

Clinical Tips and Demonstrations

Combination Intravenous Anesthesia

What I propose to discuss is combining three sedative drugs — methadone hydrochloride, scopolamine hydrobromide, and pentobarbital sodium — to produce anesthesia in dogs by intravenous injection.

Methadone hydrochloride, sold as adanon®[1] and dolophine®[2], is a morphine substitute and has most of the physiological properties of morphine sulfate. For purposes of preanesthetic sedation, it has two distinct advantages: First, it is stable in solution and is available in a milligram per cubic centimeter solution, which makes possible more precise control of dosage; second, it may be administered intravenously without producing excitement.

Scopolamine hydrobromide is a member of the atropine family. Its principal action is sedative and analgesic. It is the classic companion drug to morphine for anesthesia. In its sedative action, it depresses the vagus nerve, thus producing an accelerating action upon the pulse and respiratory system. Intravenous injection of a therapeutic dose produces an immediate acceleration of respiration.

I shall not dwell upon the description and action of pentobarbital sodium. Veterinary practitioners are intimately acquainted with this particular drug.

In my discussion of dosages, time intervals, and combinations of these drugs, I can cite only my own personal experience. So far as I know there are no published reports of the use of this combination of drugs in veterinary surgery.

My dose of methadone depends upon two groups of general factors. First, of course, is the size, age, and general condition of the dog. In older animals, I am more generous with methadone than in young, vigorous animals. The second factor is schedule of surgery in relation to administration. In the event I plan to operate as soon as the patient and my instruments are prepared, I use between 0.1 and 0.25 mg. of methadone per lb. of body weight. I administer scopolamine simultaneously, usually in the same syringe. If an interval of an hour or more is anticipated before surgery, I use 0.5 or 0.66 mg. of methadone per lb. body weight. In old or out-of-condition dogs, I sometimes use as high as 1 mg. per lb. live weight. Scopolamine is given immediately before pentobarbital sodium. I believe that pentobarbital sodium is far more depressing than methadone; therefore, I prefer to achieve the respiratory lift of scopolamine at the time the barbiturate is producing the greatest depression.

Scopolamine dosages are less variable than those of the other members of the combination and 1/200 gr. serves for any dog from 20 to 60 or 70 lb. For the toy breed, 1/400 gr. is effective. Scopolamine is available in hypodermic tablets. I dissolve a dose in 10 cc. of normal saline solution.

Far less pentobarbital sodium is required to produce surgical anesthesia when it is used following methadone and scopolamine, than when it is used alone. As a general rule, the heavier the dose of methadone, the lighter the dose of pentobarbital. By using 1 mg. of methadone per lb. of dog, I have produced surgical anesthesia with 1 gr. of pentobarbital for each 20 lb. of body weight. Usually 0.1 mg. per lb. will reduce the dose about one-half. For most routine surgery, the additional analgesic action of methadone and scopolamine permits surgery without struggling under a lighter stage of anesthesia than is possible using a barbiturate alone. I stop the injection at the point at which ocular reflexes are practically *nil*, and pinching the interdigital web produces only slight tightening of muscles, but no movement.

Use of a combination of sedative agents in anesthesia has several advantages over all of the commonly used injectable agents used alone. Its principal advantage is that it is safer. This combination permits surgery on dogs whose age and condition make inadvisable the use of barbiturates alone. In addition, this combination does away with those nerve-wracking experiences with the timid, spoiled house-pet types which exhibit convulsive movements under light doses of barbiturates, then collapse under the amount necessary to quiet. Recovery is faster than following pentobarbital, although not so fast as with pentothal®[3] or surital®[4]. Almost always awakening is quiet, unmarked by excitement or fear.—*H. C. Hall, D.V.M., Tampa, Fla.*

®[1]Winthrop-Stearns, Inc., New York, N. Y.
®[2]Eli Lilly & Company, Indianapolis, Ind.
®[3]Abbott Laboratories, North Chicago, Ill.
®[4]Parke, Davis & Co., Detroit, Mich.

Circumcision of Brahma Bulls

Injuries to the sheath of the Brahma and pendulous sheath type bulls are a problem in our section. The organ is large, low, and subject to laceration by brush, wire, fences, etc., causing inflammation, perhaps screwworm infestation, and resulting in strictures that prevent service.

Normal anatomy of the sheath includes a pocket that is responsible for the difficulties. There is also a great deal more skin, loose and hanging in fold, than that of bulls of the English breeds.

Relief is offered by radical surgery in event of stricture. Under general anesthesia (2.5 oz. chloral hydrate in 500 cc. water, given intravenously to effect), the prepuce is cleaned, shaved, and other preparation made to assure prompt healing. The operative site is usually an area 3-4 inches from the hair line, but may vary depending on the location of the stricture. There is an abundance of subcutaneous tissue between the skin of the prepuce and the lining membrane, which is extremely vascular. Incision is made along each side of the prepuce, and a generous section removed. The mucous membranes are sutured to the skin using nylon skin sutures size 0 or linen. These are placed carefully and pulled tightly. Vessels are ligated and infection and screwworm infestation controlled. Some important "don'ts" gained the hard way are: (1) Don't cast the bull with small ropes or pull them tight enough to restrict circulation; (2) don't operate until the area is free of infection and swelling; (3) don't use harsh screwworm medicine; (4) don't do any suturing until bleeding has ceased.—*J. W. MaDill, D.V.M., Dade City, Fla.*

Rattlesnake Bite Therapy

We employ a 20% solution of calcium gluconate for treatment of snake bite in dogs. Quantity injected will depend on the location of the wound, swelling, etc. This little dog, weighing approximately 18 lb., will receive about 20 cc. of solution injected in and around the point of venom injection, in addition to 10 cc. intravenously and 1 cc. of penicillin to combat secondary infection.—*H. L. McGee, D.V.M., Miami, Fla.*

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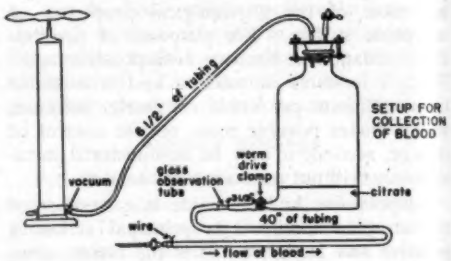
A swab saturated in Monsell's solution adequately controls hemorrhage following canine tonsillectomy if allowed to remain in the crypt.—*H. L. McGee, D.V.M., Miami, Fla.*

A Technic for the Collection and Transfusion of Blood in Cattle*

In the collection of blood by this technic, 400 cc. of 2½% sodium citrate solution are poured into the aspirator bottle and just enough is allowed to escape so that the inlet tubing and needle become coated with the solution. A 2-in., 12-gauge needle is guided into the jugular vein and the rubber tubing is attached to the needle. The apparatus should already have been assembled (see fig. 1) so that the long length of tubing at the top of the



bottle has attachment to the vacuum side of the pump. Only slow strokes of the pump are needed to secure the blood from the distended vein of the donor animal; in fact, in our experiences, as few as 25 strokes deliver a gallon of blood within six to eight minutes. In the event that the pump is worked too fast, bubbles begin to form on top of the blood. If this occurs, the vacuum may be released by removing the clamp on the rubber tubing which is attached to the capillary tubing at the top of the bottle. Experience will teach the proper length of intervals between strokes to give maximum results. Before the needle is removed from the vein of the donor animal, the vacuum in the bottle is released. Thirty-six hundred cubic centimeters of blood have been taken from a 700-lb. animal without evidence of shock within the time indicated above.

After approximately four liters of citrated blood have been collected, a small amount of citrate solution is sucked through the needle and its tubing so that blood will not become clotted therein. A Day's pinchcock clamp serves the purpose of keeping blood from flowing from the bottle after completion of blood collection.

The transfusion of blood necessitates the

*Original article: Simpson, Charles F., Sanders, D. A., and French, R. B., A Technique for the Collection and Transfusion of Blood in Cattle. *Jour. Am. Vet. Med. Assn.*, 120:17 (Jan.), 1952.

changing of the rubber tubing from the vacuum to the pressure side of the pump and the use of a 16-gauge needle. It is also necessary to replace the observation tube with the filtration tube. A double thickness of cheesecloth inserted in the top of the filtration tube and held in place by a washer acts as a filtering mechanism. When the apparatus is assembled for transfusion, a gallon of citrated solution can easily be injected at any desired rate. When most of the blood has been injected, the pressure in the bottle is released and the remainder of the blood can be run in by gravity. — *Charles F. Simpson, D.V.M., Gainesville, Fla.*

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Teat Surgery

Successful teat surgery on a lactating cow is dependent on complete restraint. Our method, casting to lateral recumbency, is accomplished by laying a rope over the withers and crossing the ends between the forelegs and up and over the back to the opposite side, thence between the thighs and udder. Tension on the rope ends will throw the cow, after which the rope can be used to secure the hind legs in extreme flexion. An assistant holds the tail and otherwise assists in giving clear access to the udder and teats.

We use plastic teat tubes which serve the purpose of draining the milk cisterns and allowing injection of medicaments without removal of the tubes. The tubes are also light of weight and easily retained. They may be firmly secured by a stainless steel stay-suture when necessary. Tubes may be obtained from Dr. Larson's Animal Hospital, Fergus Falls, Minn. — *J. A. Acree, D.V.M., Jacksonville, Fla.*

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Treatment of Coxo-femoral Luxation

Our technic of replacing and bandaging dislocated hips under local anesthesia is as follows:

Two to 3 cc. of 3% novocain® is injected over and around the site of luxation. The area then should be gently massaged for four to five minutes to allow for complete infiltration and absorption. If anesthesia is complete the luxation can be replaced in the usual manner, with no discomfort to the patient.

Bandaging consists of flexing the leg completely and wrapping it with a two-inch width of gauze. This is covered with strips of three-inch tape. The leg is not secured to the body in any way, but is left hanging in the gauze and tape. The covering is removed in three to five days. — *I. C. Frederickson, D.V.M., Hollywood, Fla.*

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Anesthesia Aids

To prepare this dog for intratracheal ether anesthesia, we use demerol,®[1] 5 to 10 mg. per lb. of body weight, as preanesthesia sedation and follow with intravenous sodium pentothal to effect. Just enough of the latter is given to allow induction of ether. This usually approximates one-fourth the average anesthetic dose.

A standard intratracheal tube fitted with a collar is inserted, after placing a speculum in the mouth of the patient. A rubber tube is then connected to the ether apparatus for maintenance of deep surgical anesthesia. The tube may be disconnected from the ether dispenser to allow a free flow of air into the lungs or it may be attached to an oxygen apparatus. Recovery from ether inhalation anesthesia is prompt and without excitement though effects of the narcotic injected may persist for six to eight hours.—*Glenn J. Lawhon, Jr., Hartsville, S. Car.*

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For bacillary diarrhea: 5 gm. of streptomycin in 10 cc. solution, as prepared by Chas. Pfizer & Co., is added to 50 cc. of citralka®[2] liquid. Give one teaspoonful to one tablespoonful, two to four times daily. Our results suggest that this prescription is more effective than administration of antibiotic tablets. — *Glenn J. Lawhon, Jr., Hartsville, S. Car.*

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Diarrhea in Calves

Our favorite formula for control of scours in young calves is as follows: Mix three parts of kaolin-pectin milk of bismuth preparation with one part of paregoric. Dose recommended for calves up to 100 lb. is 2 oz. of the mixture the first dose, with 1 oz. every 12 hours thereafter. When necessary we use the above preparation in which various sulfonamides have been added. In severe cases, dihydrostreptomycin *per os* is also used. Dosage of from ½ to 1 gm. per 100 lb. every 12 hours is sufficient.—*John E. B. Mouw, Miami, Fla.*

®[1]Winthrop-Stearns, Inc., New York, N. Y.
®[2]Parke, Davis & Co., Detroit, Mich.

Therapy of the Anal Glands

Much anal gland surgery in the dog is unnecessary. Success of treatment depends on proper administration of agents active against both Gram-negative and Gram-positive organisms. Many types of microorganisms are involved in the clinical manifestations referred to as infected anal glands.

Technic recommended is gentle expression of the gland contents. This may be accomplished by inserting the gloved forefinger into the rectum and massaging the contents through the duct with the forefinger and thumb. Satisfactory emptying of the gland may also be accomplished by gentle pressure over the fundus of the gland lateral to the rectum.

After emptying, inject a warmed, soft ointment by way of a glass syringe to which an 18-gauge round-pointed needle has been fitted. This may be done without distress to the patient. The opening of the gland is easily exposed by slight pressure at the side of the rectum. In lieu of syringe and needle, collapsible tubes fitted with suitable tips are also available. Those containing soft ointment bearing a combination of streptomycin and neomycin have proved efficacy.—*S. F. Scheidy, D.V.M., Glenolden, Penn.*

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Kidney Function Test

Concentration of urine is the most sensitive indicator of kidney function. If water and liquid food are withheld and the patient concentrates urine voided to a specific gravity of approximately 1.020, we know that the dog has normal kidney function. — *D. L. Coffin, D.V.M., Boston, Mass.*

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Nonspecific Conjunctivitis:

Rx Zinc Sulfate	1 gr.
Propadrine Hydrochloride, 3%	1 fl. dr.
Pontocaine Hydrochloride, 2%	1 fl. dr.
Rose Water	qs. ad. 1 oz.

M. Sig. 3 gtts. in eye t.i.d.

—*R. F. Minnick, D.V.M.*

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A human rectoscope serves well as a vaginal speculum to bring the urethral opening of a bitch into view. The dog is restrained in lateral recumbency with the hind legs brought forward. A catheter can be inserted easily without distress to the patient.—*J. E. Greene, D.V.M., Auburn, Ala.*

Bleeding Cats and Small Dogs

Shave the posterior margin of the ear with a Bard-Parker blade and nick the marginal ear vein. Wipe the blood as it wells out and then collect a quantity sufficient for hemoglobin test or white blood count.—*D. L. Coffin, D.V.M., Boston, Mass.*

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To avoid aspirating the rubber tracheal tube, a length of adhesive tape is wrapped around it and the end tied across the nose of the canine patient. — *Francis Candlin, D.V.M., Denver, Colo.*

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Infectious Canine Hepatitis

(Continued from page 200)

2. Virus of this disease is not airborne, as in canine distemper, and a separation of two feet between susceptible animals will prevent spread.

3. Transmission can result from handling the mouth and lips of infected dogs, and then susceptible ones.

4. Spread of the disease in kennels can be controlled by isolation, and any secretion from an infected animal must be prevented from reaching mouths of susceptible dogs. Virus in a highly contagious form may be shed in the urine of a dog for six months or longer after recovery.

5. Feeding and watering dishes should be properly cleaned and sterilized, since a dirty dish used by an infected dog might carry infection to a susceptible animal. Paper dishes should be destroyed.

6. Distemper inoculations do not activate the disease.

7. Fatalities approximate 10% of total infected, but recovered animals usually have long convalescent periods; often never fully recover.

8. The viruses of Carré and infectious canine hepatitis may produce infection simultaneously. This dual infection is most severe and usually fatal.

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EDITORIAL COMMENTS

Individualized Brucellosis Measures

In lieu of specific control measures, attempts are often made to eradicate diseases by copying procedures that have been found successful with other diseases. While better than nothing, such measures do not reach the goal of disease eradication. Experience has demonstrated that disease outbreaks must be attacked by individual planning and resourcefulness, rather than by stereotyped mental processes and repetitive movements.

Despite the importance of individualized control measures, the attempt has been made to control brucellosis by applying the successful pattern of tuberculosis control. In so doing, basic differences in the diseases have been overlooked.

Brucellosis is a rapidly spreading, elusive disease for which there is no reliable test. While the blood agglutination test in itself is not deficient, it is not infallible. Rather, it is the interpretation that is deficient.

Animals that produce low titers, or those that produce them slowly, are often considered negative on one test; whereas a subsequent test might prove them infected. It must be realized that the blood test is not a true index to Brucella infection.

If control is to be successful, the individual nature of the disease must be recognized and tailor-made recommendations developed.

We should not attempt to make disease conform to the often outmoded clothes of an elder brother.

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Vaccine for Bovine Leptospirosis

Because evidence has indicated that vaccination could have considerable effect in controlling leptospirosis, Charles J. York and James A. Baker (*Am. Jour. Vet. Res.*, 14:5 [Jan.], 1953) cultivated Leptospira organisms (Cornell strain T-262) in eggs, inactivated them by freezing and thawing, or by formalization, and prepared suspensions of the material. Guinea pigs developed protection when 1/16 ml. was administered subcutaneously, and from this, potency tests were devised that made evaluation of the vaccine possible.

They reported that this vaccine should provide a serviceable immunity, interrupting slow spread of the disease and adequately protecting exposed animals.

Livestock Group Recommends No Meat Controls

Concern of cattlemen with falling prices of cattle has led to the formation of an advisory group. Recommendations have been made to the Secretary of Agriculture that no standby controls be imposed after those now in effect expire on April 30.

Instead, the group advocates action to bring facts regarding supply and demand for beef to the attention of the consuming public. More beef for the armed services, school-lunch programs, and the Korean army were further items recommended for attention, intended generally to assist in establishing a sound operating program for the industry.

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Iowa Law Requires Cooking of Garbage

With the exception of only one dissenting vote, the Iowa legislature unanimously approved a bill regulating garbage feeding. It was signed next day by the governor and becomes effective June 1, 1953.

The new law requires that garbage fed to animals must be heated to a temperature of 212 F. for 30 minutes, or other acceptable methods used to make it a safe food. License will be required by those who process public or commercial garbage.

Other state law-making bodies have passed similar legislation and still others have bills pending.

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Weld County veterinarians (Colorado) have instituted what is believed to be a unique medium for public relations. They invited clients to engage in a forum of veterinary problems in client relations. Subjects discussed included farm facilities for handling stock, effect of the dispensing of veterinary products by drug stores, client attitude toward waiting for service, and referring cases.

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During the week ending March 7, the first week after removal of the United States embargo on Canadian cattle, 806 head of slaughter animals were shipped from the United States to Canada; only 63 head were imported from that country. — *Natl. Prov., March 21, 1953.*

A.A.H.A. Meeting at Minneapolis, May 7-9, 1953

The American Animal Hospital Association will convene in annual meeting at the Hotel Radisson, May 7-9, 1953. President Myron A. Thom, Pasadena, California, has announced that the literary program is in reality much more than that—it is a short course in small animal medicine and surgery. There will be a half-day devoted to feline practice, virus diseases, diets, cystitis, and urolithiasis; a half-day to radiological technics and interpretation, a survey of radiology, fundamentals, exposure factors, positioning, darkroom technic, radiation protection, and interpretation of findings.

Those interested in canine practice will hear discussions of canine opthalmoscopy, immunity against virus diseases, diagnosis and treatment of leptospirosis, nephritis, anesthetics, fracture management, the cause and treatment of pyometra, and the use of metal heads in femoral repair.

Allied Laboratories, Inc., and Radio Corporation of America will sponsor television demonstrations of modern surgical technics.

In addition to the usual social functions, there will be planned outdoor activities including a ride to the Golden Valley Country Club where a handicap golf tournament complete with trophies will be played, and a tour through the new School of Veterinary Medicine, at the University of Minnesota. There will be a luncheon especially for the ladies and a style show at a downtown shop.

Outstanding educational features will be found in the lobbies where commercial exhibitors will present current commercial products and educational displays. In addition, there will be a demonstration of laboratory technics by students of the School of Veterinary Medicine of the University of Minnesota.

All veterinarians and their wives are invited to attend. Those desiring hotel reservations or programs are requested to write Dr. W. H. Riser, 5335 Touhy Ave., Skokie, Illinois.

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Red Tape Ties Animal Disease Control

The difficulties that one Illinois farmer experienced in getting assistance of disease-control officials are outlined in a step-by-step feature story which appeared in *Prairie Farmer*, March 7, 1953.

The disease suspected was scrapie, a California outbreak of which recently was widely publicized, as was the control action taken in that state. In this instance, the farmer was said to have cooperated in every way possible but that regulatory authority failed to grasp the initiative and follow through with institution of control measures. A delay thus occurred which might have proved disastrous if the disease had been characterized by rapid spread. It has since been announced that one farm in Illinois and five in Ohio have been quarantined because of scrapie in sheep.

The veterinary profession will agree that regulatory authority is too far behind sound disease-control recommendations.

Is our disease-control organization so complex that efficiency has been sacrificed? If so, the livestock industry does not have the protection intended by those who originally proposed state and federal regulation to prevent the spread of disease.

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The number of cattle in Mexico has increased by approximately 25% since 1946 when an importation band was enforced because of foot-and-mouth disease. According to a recent statement by the president of the National Cattlemen's Association, the number of cattle in Mexico has increased from 12,000,000 head to 15,000,000.

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The Pennsylvania Holstein-Friesian Association, in its recent annual meeting, approved a resolution asking for a School of Veterinary Medicine at Pennsylvania State College.

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A small booklet entitled Immunization Information for International Travel can be obtained for 15 cents from the Government Printing Office, Washington 25, D. C.

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Economists have said that when annual farm income drops $3,000,000,000., a million industrial workers lose their jobs. Inroads made by disease among livestock may have far-reaching effects on the national economy.

Toronto Host to the 90th Annual A.V.M.A. Meeting, July 20-23, 1953

Members of the A.V.M.A. fortunate enough to attend the 90th annual meeting in Toronto, July 20-23, will find themselves in a beautiful, modern city that has a historical background through which have marched warlike aborigines, fur traders, and pioneers in many fields.

Warlike Hurons once roamed the area bounded by the three great lakes: Huron, Erie, and Ontario. At the beginning of the 17th century the Hurons numbered about 30,000 and had banded with the Tionontate and other minor tribes to form the Great Iroquois Nation which was a fierce adversary of the Five Indian Nations. War and disease so weakened them, however, that they became easy prey for their enemies and for encroachments of the white man.

When the Hurons began to vacate the area and push north and west, a French trading settlement was founded on the curving north bank of Lake Ontario, in an inlet opposite the mouth of the Niagara. The French constructed a fort there in 1749 and soon a mighty beaver trade was thriving. The Indians called the settlement "Toronto—a place of meeting."

French-Indian trade prospered there until 1759 when the fort was burned to prevent British occupation. A British governor subsequently renamed the settlement York, but a later reform caused the name to revert to the aboriginal idiom, Toronto. In 1813, the town was destroyed by fires set by invading forces from the south.

Today, Toronto is the capital of the Province of Ontario and boasts a population of 1,000,000. It has an active shipping trade. It is the center of the most productive farming area in the Dominion and through its facilities large quantities of grain, fruit, and livestock are exported to Europe. The city's packing establishments cause it to be known as the "Chicago of Canada."

Toronto's fine hotels will provide splendid facilities for a meeting that may break the previous high attendance mark set in Milwaukee in 1951. While veterinarians discuss problems at scheduled sessions their families may enjoy sightseeing and recreational events planned by Canadian hosts.

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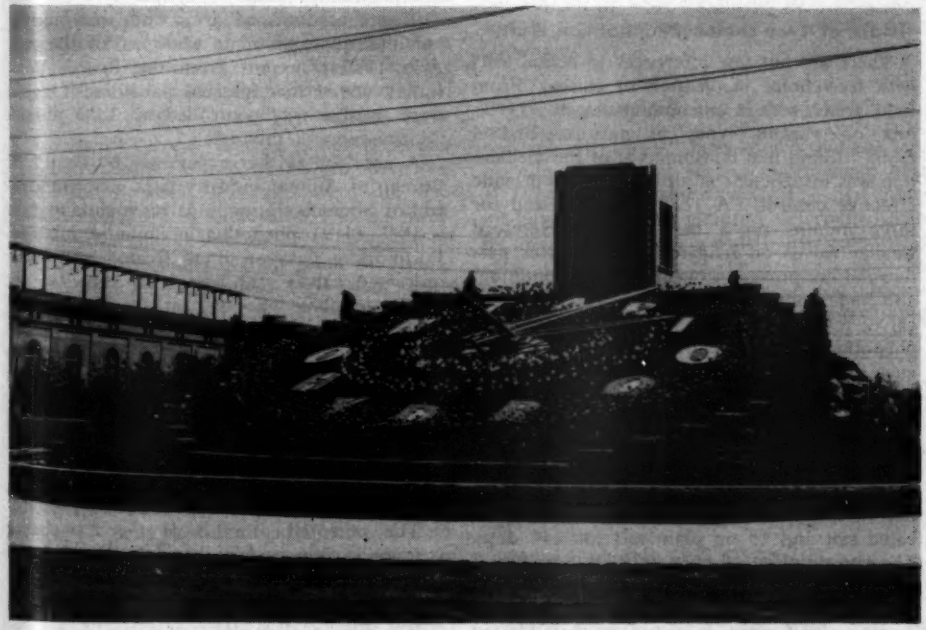
Good livestock management calls for keeping up to date and putting to use new information on animal breeding and feeding as it is developed in the research laboratory.



The Ontario hydroclock at Queenston represents a phase in the evolution of the clock. Also called a clepsydra, the original is believed to have been invented by the Chinese in 2000 B.C. Water, escaping through a small aperture causes the mechanism to turn. Note that ONTARIO HYDRO replace figures on the clock face.

VETERINARY PARASITOLOGY

A. O. FOSTER, B.A., M.A., Sc.D.
Beltsville, Maryland

Free-Choice Phenothiazine for Cattle

A decade of successful field experience with free-choice administration of phenothiazine in salt and mineral mixtures to sheep, the promise of this and other systems of continuous or intermittent low-level medication for horses and goats, and certain special extensions of this regimen of parasite control have indicated clearly the desirability of ascertaining applicability to cattle of a free-choice regimen or of some other efficient system of low-level medication for parasite control. The urgency of this, like all measures toward improved production which only research can provide, is emphasized by present shifts toward further and more concentrated grassland production, heavier stocking, and increasing trends to permanent pastures. It seems both timely and pertinent, therefore, to review the status of free-choice antiparasitic medication for cattle, a subject on which experimental work is now in progress with notable developments possibly close at hand.

Trials of Free-choice Regimen on Cattle

There are but few references to actual tests with free-choice medication of cattle. From field trials with a phenothiazine-salt (1:10) mix on various types of pasture, Britton *et al.*[1,2] found that consumption of the medication was insufficient in all instances to provide effective control. A 1:15 mixture tested for three months on a herd of 400 Hereford weaner calves on irrigated ladino clover pasture did not prevent scouring, loss of condition, and high counts of "stomach worm eggs", but calves responded promptly to 20 gm. doses of phenothiazine. Repetition of the experiment gave the same unsatisfactory results.

Harwood *et al.*[3] used a phenothiazine-salt (1:10) mix on Hereford beef calves in Ohio that were grazed on blue grass and white clover. In 1943, 13 steers were provided with medicated salt and 12 with plain salt for 113 days. The following year, 14 were on medicated salt and 15 on plain salt for 144 days. The consumption of phenothiazine was 4 to 5 gm. daily by 600-lb. animals. This was sufficient to achieve direct anthelmintic effect. Of greater significance is the fact that treated calves gained more weight than those on plain salt, showed lower egg counts during the experiment and fewer worms at autopsy. Infestations were moderate and none of the animals suffered from clinical parasitism, yet treated calves gained, on the average, 20.5 lb. more than the untreated in 1943, and 15.3 lb. more in 1944.

Trials by the U. S. Bureau of Animal Industry[4] gave generally promising results with a 1:19 mixture of phenothiazine and mineral supplement. Initial trials on separately pastured calves indicated that a daily intake of 0.5 to 2.5 gm. per animal was the desired goal. Other experiments suggested that a base of mineral supplement might be more satisfactory than plain salt, and that a 1:10 concentration might be too high. Some animals apparently found this concentration unpalatable. On a supplement of timothy hay and grain, consumption per head of a 1:25 salt-base mix was only 0.4 gm. of phenothiazine daily by eight calves during a test period of 117 days. Seven calves on a 1:19 mineral mixture for successive periods of 55, 55, and 68 days, respectively, on timothy, alfalfa, and timothy consumed sufficient amounts of drug while on timothy but inadequate amounts while on alfalfa.

In 1947, a report from the British West Indies[5] stated that internal parasites of cattle were satisfactorily controlled by 1:13 phenothiazine-mineral mixture.

A note[6] on further experience by the U. S. Bureau of Animal Industry cites efficient control of stomach worms in calves maintained on a 10% (1:9) phenothiazine-mineral mixture. Postmortem data on three treated and three untreated calves that had been kept for six weeks to three months on the experiment showed 60 times more stomach worms in untreated calves. Significantly, stomach worm infestation progressively decreased in animals receiving medication, a result which again suggests delayed anthelmintic effect of small doses.

Data from Low-level Dosage to Cattle

The potential promise of the free-choice regimen is supported by corroborative evidence

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[1] *Cornell Vet.*, 33:339, 1943.
[2] *Vet. Med.*, 39:239, 1944.
[3] *Jour. Tenn. Acad. Sci.*, 20:159, 1945.
[4] Report, Chief, BAI, 1945, p. 33.
[5] West Indian Vet. Conf., 1:6, 1947.
[6] Report, Chief, BAI, 1952, pp. 64-65.

apart from the remarkable effects achieved by low-level or free-choice administration of phenothiazine to sheep, goats, horses, and dogs. Direct information on the action of small daily doses against cattle parasites has been obtained.

In a pioneering study, Andrews[7] demonstrated that egg production of Haemonchus, Trichostrongylus, Bunostomum, and Oesophagostomum was reduced to insignificance when calves were given phenothiazine at the rate of 0.5 gm. per 100 lb. of live weight per day, a dosage that approximated the rate for sheep recommended by Shorb and Habermann in 1940.

Mayhew showed in a series of studies[8,9] that daily doses of 1.5 gm. of phenothiazine per calf quickly caused appearance of abnormal Oesophagostomum eggs incapable of development to infective larvae, then cessation of egg production. This effect was achieved in some instances by as little as 0.5 gm. per animal per day for 14 days. Upon discontinuance of therapy, moreover, the animals remained negative for long periods. A daily dose of 1.5 gm. per calf was found also to cause disappearance of Haemonchus eggs in from five to 14 days. On the other hand, this dose did not reduce egg output by Bunostomum, but did prevent development of infective larvae. Therefore, although the specific effect was different on the three aforementioned species, the end result was the same from the standpoint of the objective of small daily doses as a control regimen.

Cauthen[10] carried on many experiments giving daily doses from 0.2 to 5 gm. to calves and mature stock. Findings were not uniformly indicative of an advantage of the medication from standpoints of egg counts, larval counts, worm counts, weight gains, or general condition of animals, but his 1951 report states that 1 gm. doses were 99% effective in suppressing development of infective larvae in feces of treated calves. In a report just published,[11] moreover, there is good evidence that 2 gm. daily to 500-lb. yearlings are adequate to accomplish this. Significantly, as little as 0.7 gm. nearly prevented embryonation of ova that had been washed free of feces.

Another recent study by Brock, Pearson and Kliewer[12] gives general support to the efficacy of low-level dosage. Their results, like those of Cauthen, are not in detailed agreement with those of other workers, but it should be noted that attention was directed to possible control of lungworms by this regimen. This may be a vain hope, but a point is emphasized that has become evident in sheep; namely, that free-choice or low-level dosage has a broader spectrum of action than any system of therapeutic dosing.

General Comment

While it is evident from this brief account that no applicable regimen of free-choice administration of phenothiazine to cattle has been devised, it seems also probable that no specific regimen will prove generally applicable. The employment of 5 to 10% of phenothiazine in salt or mixed minerals has worked efficiently in some instances but failures have occurred. The determining circumstances are not apparent, although diet is a possible factor. From the standpoint of speciation, data are adequate to show that Haemonchus, Bunostomum, and Oesophagostomum are subject to control by minimal daily intake of phenothiazine, but more data are needed on smaller species. It may be presumed, moreover, that the pitfalls of the free-choice regimen that have been defined for sheep[13] are applicable also to any use of it for cattle. Finally, the outlook for successful application of the regimen to cattle is bolstered by a reasonably clear indication of the dosage that should obtain, namely, 0.5 gm. of phenothiazine daily per 100 lb. of body weight up to a total dose of 2 to 5 gm. per head daily for animals over 500 pounds.

Life-History of the Lancet Fluke

Krull and Mapes[14] have shown that the ant, *Formica fusca*, is a second intermediate host of *Dicrocoelium dendriticum*. The first intermediate host in this country, determined also by these workers, is the widely distributed land snail, *Cionella lubrica*. Other hosts may be found, but in this elucidation of the life-history, the authors have solved a problem of long standing; they have also contributed significantly to knowledge that is essential for eventual control of this recently introduced parasite of ruminants.

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[7] *Jour. Agri., Un. Puerto Rico*, 27:125, 1943.

[8] *Jour. Parasitol.*, 34(6, part 2):14, 1948; 35(6, part 2):12, 1949; 36(6):536 and (6, part 2):35, 1950; 37(5, part 2):28, 1951; 38(4, part 2):30-31 and (6):525, 1952.

[9] *Proc. Helm. Soc. Wash.*, 18:70, 1951.

[10] *Jour. Parasitol.*, 37(5, part 2):14, 1951; 38(4, part 2):31 and 34, 1952.

[11] *Am. Jour. Vet. Res.*, 14:30, 1953.

[12] Proc. Book, *Am. Vet. Med. Assn., 89th An. Mtg., 1952*, pp. 167-171.

[13] *Vet. Med.*, 48:34, 1953.

[14] *Cornell Vet.*, 42:603, 1952.

PUBLIC HEALTH

JAMES H. STEELE, D.V.M., M.P.H.
Atlanta, Georgia

Brucellosis in Man

A recent report of a study of 35 cases of human brucellosis by Wendell H. Hall, University of Minnesota Medical School, suggests that any febrile illness among veterinarians, farmers, and packing plant employees be suspected as brucellosis. Doctor Hall reported that his patients who were hospitalized with acute brucellosis were mainly residents of Wisconsin and Minnesota. They were all male. The breakdown as to the probable source of infections was:

13 farmers who owned cows that had brucellosis.

15 packing plant employees (four worked on the beef kill, eight on the hog kill, and three were not exposed to fresh meat).

1 veterinarian.

6 patients who had no direct animal contact; five of these drank unpasteurized milk and the sixth had a job that brought him into frequent contact with manure.

The editor points out that many of the above cases fall into a category of compensable occupational disease and the physician should be aware of this.

A report such as this makes all realize that brucellosis continues to be a significant public health problem in the United States, even though there has been a steady decrease in the number of human cases reported. In 1946, there were more than 6,000 human cases reported. By 1952, the reported number of cases had dropped to less than 3,000, which is a 50% reduction in six years. In 1946, it was estimated that about one-third of the infections were due to the ingestion of Brucella-contaminated raw dairy products and that the remainder of the cases were due to occupational exposure among veterinarians, farmers, and packing house workers. There are no available data for the source of infection of the 1952 cases but it is believed that the ratio described by Hall would be applicable in most parts of the United States. The cases described by Hall indicate that five out of 35, or approximately 15%, were probably due to the ingestion of contaminated milk. The reduction in the number of cases attributable to the ingestion of raw dairy products probably is one of the important reasons for the 50% decline in the past six years. Apparently there are fewer cases among veterinarians and farmers due to animal exposure since cases in rural areas have fallen off considerably. There is little or no data available on incidence in animal handling industries. In many instances, these cases are not reported.

The veterinary profession has a public health responsibility in the control and eradication of brucellosis. To carry out this responsibility it is important that the veterinarian inform all farmers and animal handlers that they are risking their health and the health of their families and employees as long as they allow diseased animals to remain on their farms and premises. In this problem, the veterinarian has probably one of the biggest stakes in so far as health is concerned. Veterinarians have the highest attack rate of any group. The rate among them is over 250 per 100,000 while among male farm workers it is about 45 per 100,000. The eradication of brucellosis will contribute both to the health and economic welfare of the veterinary profession, the farmer, the packing house employee, and the public.

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In the *Canadian Journal of Comparative Medicine and Veterinary Science* of October 1951, Plummer of the Division of Animal Pathology, Science Service, Department of Agriculture, Animal Disease Research Institute, reports exhaustively on A Survey of Sixty Tumours From Domesticated Animals. Of the total of 60 tumors, 37 were of bovine origin and in regard to these it is reported that, "Lymphosarcoma has proved to be the most common tumor of cattle." Again Plummer announces that "Lymphosarcoma is a very invasive tumor capable of metastasizing in any organ or tissue; occasionally it is confined to lymph glands with other organs remaining unaffected." Our personal information is that next to the Hereford eye carcinoma, lymphocytoma (Plummer's designation is lymphosarcoma) in the middle west, is occurring most frequently.

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The chicken is second only to cotton as a source of income in the south. — *Poultry Digest, November 1952.*

PRINCIPLES OF ANIMAL HEALTH

R. R. DYKSTRA, D.V.M.
Manhattan, Kansas

Glycerine Treatment for Pregnancy Toxemia in Ewes

Griffiths in the *British Veterinary Record* (Nov. 15, 1952) discusses the use of glycerol (it is official in the U. S. Pharmacopeia as glycerin) for treatment of pregnancy toxemia in ewes. Newsom in his book on Sheep Diseases names this ailment as pregnancy disease, antepartum paralysis, stercoremia, or acidosis. In attacks that were "typical enough to be diagnosed clinically", he administered *per os* 4 oz. of glycerol diluted with an equal quantity of water and a small amount of chlorodyne added. The medicine was administered warm to hasten its quicker passage into the abomasum. It is even intimated that a small quantity of a weak copper sulfate solution would hasten the passage into the small intestines for absorption. It is strongly emphasized that the glycerol mixture must be given early or before there is severe liver damage. The favorable results of this treatment were obtained after an interval of a few hours. If there should be relapses, the treatment is repeated.

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Warfarin Available in Liquid Form

Warfarin, the rodent poison, (the name is derived from the first letters of Wisconsin Alumni Research Foundation with the addition of the last four letters of cumarin, the chemical family name of its active ingredient) is now prepared in liquid form. The active agent of warfarin is dicumarol, which is the substance in sweet clover responsible for deaths of cattle from internal hemorrhage. Death from internal hemorrhage is exactly what happens to rats and other rodents consuming this powerful anticoagulant. Previously produced in solid form, it has now been made into a liquid so as to be made available to rats in drinking water. In its original form, warfarin consists of 0.5% of the chemical and 99.5% starch. It is recommended that this be mixed with grain bait in a concentration of 1:4,000. Soluble warfarin is coated on grains of sand in the old ratio of 0.5% in 99.5% of sand. One-third ounce of this sand formula is mixed with a quart of water so that the drinking water is one part of warfarin in 20,000 parts of water. A baby-chick fountain is used to make the solution available to rats. It is entirely odorless and tasteless so that there is no bait shyness. After consuming this solution for a few days, the rats die of internal hemorrhage.

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Built-up Litter

When the "built-up" litter is used in poultry houses, it must be kept dry by adding either lime or superphosphate. If it is at all moist, it will be a breeding place for coccidiosis (oocysts). Even when kept dry, some authorities recommend changing the litter after each new brood rather than permitting it to accumulate for a period of a year or longer. If cleaned up at the end of each new brood, it means cleaning it every ten to 12 weeks; this is certainly less arduous for the poultry raiser than the daily or weekly cleanings recommended a few years ago. It is not improbable that, unless carefully guarded against by approved methods of sanitation, the "built-up" litter consisting of an accumulation of a year or more may also result in build-up of the endoparasite situation in a flock.

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An inquirer asks, "Will you describe the milk test for ketosis in cattle?" A nitroprusside mixture is the reagent used. It consists of 2 gm. of powdered sodium nitroprusside intimately mixed in a mortar with 98 gm. of ammonium sulfate. Add 2.5 gm. of this mixture to 5 ml. of whole milk, shake thoroughly, and then add 1 ml. of concentrated ammonium hydroxide. The reaction requires about ten minutes, and if positive, a pink or purple color develops.

Since the ketone concentration in the milk is frequently no higher than in the blood (in the urine it may be 15 times that in the blood), the milk test is slower than the Ross urine test, and in very low ketone concentration, the color reaction may be only a light pink. Formalin in the milk from previous medication interferes with the test, though other agents such as sulfonamides, turpentine, linseed oil, iodine, salicylates, etc., do not affect the milk test for ketones.

BOOK REVIEWS

Books reviewed in this department and any other books, if available, may be obtained by remitting the published price to the Book Department, Veterinary Medicine, Suite 803 Livestock Exchange Building, Kansas City 2, Missouri.

CHINCHILLA DISEASES AND AILMENTS, by *A. H. Kennedy*, B.S.A., D.V.M., D.V.Sc., head, Department of Fur Bearing Animals, Ontario Veterinary College. 259 pages, illustrated. Fur Trade Journal of Canada, Toronto, Ontario, publishers, 1952. Price $6.

For those seriously interested in the raising and treatment of chinchillas, this book is a well-organized review of all that is known on the subject. For those with mere passing interest, it discourages them from hastily entering a field of husbandry that requires so much know-how. The author continually emphasizes the results derived from good husbandry, and these sections are valuable to both the practitioner and the layman. The sections on disease are systematically arranged under comprehensive headings that include the disease incidence, cause, symptoms, diagnosis, treatment and postmortem findings for each disease. These sections will be of interest to the veterinary practitioner, who may wish to develop proficiency in the treatment of diseases of this popular fur-bearing animal.

The work is recommended as a complete treatise not only on chinchilla diseases and ailments, but on the relationship of husbandry to their health.

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THE RACCOON by *Leon F. Whitney*, D.V.M., and *Acil B. Underwood*. Practical Science Publishing Co., Orange, Conn., publishers, 1952. Price $3.75.

Written by a well known author and veterinarian, and an eminent raccoon raiser, this book will be of interest not only to other raisers, but also to naturalists and the laity in general. While veterinarians in most areas are not called frequently to treat raccoons, the book nevertheless holds interest for them as animal lovers and students of animal nature. It contains valuable information on coon varieties, modes of inheritance, mental characteristics, diseases, parasites, and legal protection.

The book is a fascinating and interesting account of the "masked bandit of the woods." The photographs alone are worth the price asked for the book.

PARASITIC ANIMALS, by *Geoffrey Lapage*, M.D., M.Sc., M.A., lecturer in animal pathology, University of Cambridge. 351 pages, 113 illustrations. Cambridge University Press, London and New York, publishers, 1951. Price, $4.

Written in clear and forceful prose by an experienced parasitologist and author, this book draws upon a wealth of personal experiences and familiarities. It is understandable, simple, and concerns parasites, how they live and grow, and their intriguing effects in the human and animal body.

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AMERICAN POCKET MEDICAL DICTIONARY. New 19th edition, W. B. Saunders Co., Philadelphia, publishers, 1953. Price $3.25 plain; with thumb index, $3.75.

Simplicity and usefulness to the reader characterize this pocket-sized edition. While it is not intended to supplant the complete information of the larger editions, it does present concise information and tables that are thoroughly modern and useful.

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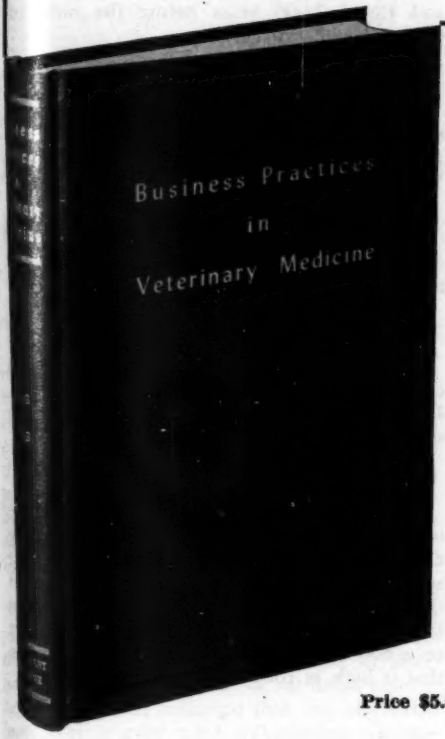

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ITEMS OF VETERINARY INTEREST

Dried snail flesh is rich in the amino acid lysine and is a rich food for animal or man.

Almond hulls can make good silage if water is added to bring moisture content up to 65%. The hulls have received favorable attention as cattle and sheep feed.

A nutritional study of children in Ohio revealed that they are not consuming the recommended amounts of green and yellow vegetables, milk, and vitamin-C-rich foods.

The effectiveness of oral procaine hydrochloride in treatment of canine cardiospasm, is enhanced by addition of methyl cellulose, which causes the mixture to adhere in the esophagus.

The first two days of a pig's life are most perilous. It is in this period that greatest losses occur, especially in lighter pigs. The young should be adequately protected from even minor chilling.

If ground yellow corn replaces all of the oats and half of the wheat middlings in an all-mash ration, there is marked feed utilization in laying hens; birds are heavier, hatchability higher, mortality is unaffected, and the litter drier.

A number of alert insurance companies have designed policies especially for the poultry industry. The broiler, fryer, and roaster grower can all be covered for general losses. Supplementary policies can insure for special situations, such as transportation losses.—*Poultry Digest, November 1952.*

There are at least four species of coccidia in the turkey. While the host limitations are not striking, other fowl are susceptible, although there may be a strain difference. *Eimeria meleagrimitis* was observed to be the only form which produced serious results. Mortality of 100% has been produced in poults due to infection by this protozoan parasite.

An English Bloodhound has been trained to sniff out leaks in underground gas mains.

Cattle branding irons were used in China and Egypt 2,000 years before the birth of Christ.—*Natl. Prov.*

A survey among American farmers shows by projection that approximately 50% use some oleomargarine in their homes.

Dr. Walter R. Haas, Eaton, Colorado, recently performed euthanasia on a 41-year-old mule. The teammate died three years ago.

A virus isolated from sheep in Israel was compared with known strains of bluetongue. Its behavior in eggs indicated that it was a strain of bluetongue.

Experimental evidence indicates that there is no growth advantage derived from feeding calves milk for nine weeks rather than for seven weeks. The capacity and function of the rumen is apparently developed by that time so that calves grow and develop normally on a non-expensive all-vegetable protein ration that is high in roughage.

According to I. D. Porterfield, University of West Virginia, Morgantown, cows kept in large stalls produced 12 to 97 lb. of milk more than when the same animals were kept in smaller stalls. The smaller quarters reduced milk production and increased the incidence of injury.

Because a bandage is no respector of living qualities in underlying tissues, it must be applied with more intelligence than haste. A bandage may close tissues on debris, causing surrounding areas to become infected. It may be applied too tightly, imperiling circulation, or it may be annoying.

A bandage should always be smooth, comfortable, and loose over a wound, yet firm enough to accomplish the purpose.